ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

WORMS MILITARY COMMUNITY

WEST GERMANY

REVISED EXECUTIVE SUMMARY

AUGUST, 1986

PREPARED FOR

DEPARTMENT OF THE ARMY

EUROPEAN DIVISION, CORPS OF ENGINEERS

CONTRACT NO. DACA 90-81-C-0096

A & E INTERNATIONAL/NEWCOMB & BOYD CONSULTING ENGINEERS

A JOINT VENTURE

ATLANTA, GEORGIA

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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EEAP - WORMS

REVISED EXECUTIVE SUMMARY - CONTENTS

1.0 INTRODUCTION AND OVERVIEW

1.1 Introduction:

This document is the Executive Summary of the Phase II Energy Report for the Energy Engineering Analysis Program (EEAP) for the Worms, West Germany Military Community. The purpose of this document is to present analysis of potential energy conservation projects at each of the sites. The EEAP provides engineering studies of Army facilities to identify and analyze facility energy conservation projects. This program has been completed, is being performed, or is planned for all Army facilities worldwide. This project provides for completion of that program for Worms Military Community, with sites at various locations throughout the Community area. Work is being performed under the direction of the European Division of the U.S. Army Corp of Engineers under Contract No. DACA90-81-C-0096. The study is being performed by A & E International/Newcomb & Boyd, Consulting Engineers, a joint venture, with home offices located in Atlanta, Georgia. Local engineering support for the project is being provided by Lahmeyer International, GMBH.

1.2 Worms Military Community Overview:

The U.S. Army Military Community Activity, Worms, consists of a headquarters at Taukkunen Barracks in Worms, a Sub-community facility in Weierhof, and 21 separate installations and sites at various locations within the 525 square mile community area. The descriptions herein refer only to the installations surveyed as part of Phase I. Installations and buildings in the Community to be surveyed were selected during Phase I in a joint meeting of Community, Corps and A/E representatives. Refer to Section 1.3.3 for a discussion of the selection of installations. Figures 1.1 and 1.2 show the location of each installation on area maps.

1.2.1 Kriegsfeld Ammo Depot (GY 035):

Located near Kriegsfeld, this site contains troop billets, community support facilities, and administrative and maintenance buildings as well as ammunition storage facilities.

1.2.2 De La Police Kaserne (GY 144):

Located in Worms, the site contains troop billets, administrative and storage facilities, a computer installation, and two grade schools.

1.2.3 Thomas Jefferson Village (GY 241):

Located in Worms, the site contains multifamily housing units and community support facilities including a commissary, school, and youth center.

1.2.4 Gruenstadt AAFES Depot (GY 256):

The facility contains a large bakery, ice cream plant, meat processing plant, and attendant cold storage and dry goods warehouses. Maintenance shops are also housed at this site in Gruenstadt.

1.2.5 Haide Labor Services Camp (GY 390):

Barracks, mess hall, and vehicle repair shop are located at this site near Haide.

1.2.6 Schoenborn Missile Station (GY 434):

The facility, located in Schoenborn, is divided into 2 sites. One site contains troop billets, recreation, motor repair, and warehouse facilities. The launch site contains a ready building and heated storage barns, one of which is currently used as office space.

1.2.7 Quirnheim Missile Station (GY 435):

The facility located near Quirnheim is presently unoccupied and undergoing renovation. It is similar in layout to Schoenborn with separate administration/ troop quarters and missile launch areas.

1.2.8 Worms R&U Area (GY 512):

The facilities engineers are headquartered at this installation in Worms. The site contains maintenance and repair shops, warehouses, and an administration building.

1.2.9 Taukkunen Barracks (GY 606):

Headquarters of the Worms Military Community, Taukkunen Barracks in Worms is composed of administrative buildings, community support facilities, communications and computer facilities, and recreational facilities.

1.2.10 Weierhof Family Housing (GY 692):

Located in Weierhof, this site contains multifamily housing units and community support facilities such as a school, chapel, and youth center. Facility engineering also has maintenance shops located at Weierhof.

1.2.11 Worms QM Area (GY 775):

This facility consists of one furniture warehouse located in Worms.

1.2.12 Dannenfels Communication Station (GY 885):

Located near Dannenfels, the installation consists of a small administrative building and communications building.

1.2.13 Hardenburg Communications Station (GY 887):

This facility located at Hardenburg consists of troop billets, mess hall, administrative building, and communications building.

1.2.14 Lohnsfeld Communications Station (GY 889):

Located at Lohnsfeld, the station consists of a barracks and receiver building.

1.2.15 Austin Radio Relay Station (GY A01):

This site contains a barracks with mess hall, a receiver, and communications building. The relay station is located on Donnersberg.

1.2.16 Gruenstadt Communication Station (GY A27):

Located near Gruenstadt, the facility contains barracks, recreation building, maintenance and administration buildings, and mobile communications equipment.

1.3 EEAP Scope and Process:

1.3.1 EEAP Scope:

The objectives of the EEAP as stated in the project Schedule of Title 1 Services are:

"a. Develop a systematic plan of projects that will result in the reduction of energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan without decreasing the readiness posture of the Army.

b. Use and incorporate applicable data and results of related studies, past and current, as feasible.

c. Develop coordinated base wide energy systems plans for each military community.

d. Prepare Program Development Brochures (PDB's), DD Forms 1391, and supporting documentation for feasible energy conservation projects.

e. Include in the program studies all methods of energy conservation which are practical (in so far as the state-of-the-art is reasonably firm) and economically feasible in accordance with guidance given.

f. List and prioritize all recommended energy conservation projects."

A complete copy of the Schedule of Services is included in the Data Report. EEAP project activity is divided into 4 increments:

1.3.1.1 Increment A:

Energy conservation projects involving modification and improvements to existing buildings are included under this increment. All projects will be evaluated according to Energy Conservation Investment Program (ECIP) criteria and ranked according to Savings to Investment Ratio (SIR). Planning and programming documents for recommended ECIP projects will be prepared.

1.3.1.2 Increment B:

This increment includes energy conservation projects for utilities and energy distribution systems. Computerized energy monitoring and control systems (EMCS) will also be evaluated under this increment. All projects will be economically evaluated using ECIP criteria, and planning and programming documents will be prepared for recommended projects.

1.3.1.3 Increment F:

This increment includes recommendations for modifications and changes in system operations to conserve energy. These recommendations are to fall within the Military Community's funding authority of $200,000 for alteration type work and $500,000 each for maintenance and repair work. Additional tasks under

this increment include analysis of the energy requirements of planned facilities listed in the Military Community's Master Plan, recommendation for additional training of facilities engineer personnel, and a study of the replacement of expendable equipment with more energy efficient types. All energy conservation measures and projects from all increments are to be summarized and prioritized under this increment.

1.3.1.4 Increment G:

Projects whose costs exceed the local community's funding authority and have an SIR greater than 1, but an ESIR less than 1, qualify for inclusion under Increment G. These projects are those which are too costly for inclusion in Increment F and save dollars, but not enough energy to qualify for ECIP funding under Increments A and B.

These projects would be funded from maintenance, repair (OMA), and minor construction projects (MMCA) funds. However, no Increment G projects were identified during this analysis.

1.3.2 EEAP Process:

An EEAP project is performed in three phases as follows:

1.3.2.1 Phase I:

The primary purpose of this phase is to gather energy related site data (written and verbal) and perform a field survey of the site to identify existing facility physical and operational conditions. The Prelimi-

nary Submittal occurs at the end of Phase I and documents the data gathered during Phase I. This information is contained in the Revised Data Report.

1.3.2.2 Phase II:

During this phase, the information obtained during Phase I is analyzed to identify energy conservation projects. Once those projects are identified, they are analyzed to project potential savings and cost which would occur if the projects were implemented. The savings and cost are analyzed using standardized economic procedures and then prioritized based on that economic evaluation. The Interim Submittal is provided at the end of Phase II and documents the project selection and analysis process. The Interim Submittal consists of the Energy Report and other miscellaneous documents.

1.3.2.3 Phase III:

During this phase, funding documents (Forms 1391 and Program Development Brochures) are prepared for those projects identified in Phase II as having economic characteristics which satisfy the appropriate criteria (ECIP). At the completion of Phase III, the Pre-final Submittal is made and includes all proposed funding documents. Government comments on the Pre-final Submittal are then incorporated in a Final Submittal.

1.3.3 Project Scope:

The work in this project includes both buildings and utility systems. Funding for the project is not sufficient to perform detailed survey and analysis of every single building in the community; therefore, two different survey procedures were applied. A detailed building survey aimed at collecting sufficient data to create a computer model of the building's energy use profile was performed on a limited number of representative buildings. The remaining buildings were surveyed in somewhat less detail to catalogue existing equipment and conditions and correlate the building with one of the buildings to be modeled by computer.

A "kick off" meeting was conducted in the community prior to the commencement of the Phase I field survey with representatives of the community, European Division Corps of Engineers, and the A/E in attendance. At this meeting the list of installations was reviewed and the installations listed in Figure 1.3 omitted from the survey. The building lists of the remaining installations were then reviewed. Buildings such as guard towers, unheated warehouses, and ammunition storage facilities were deleted from the survey due to low energy consumption and minimal opportunity for energy conservation. The list of buildings to be surveyed in detail for computer modeling was also finalized. Refer to Figure 1.4 for the list of installations surveyed. Figure 1.5 contains a list of buildings surveyed with the buildings surveyed in detail noted.

In addition to buildings, the utility systems at each site are included in the scope of the investigation. Utility systems included are boiler plants, electrical and thermal distribution, and exterior lighting.

1.4 Executive Summary Scope:

This report provides a summary of the energy and cost analysis leading to recommendation of proposed energy conservation projects documented in the Energy Report. The Energy Report's prime objective is to use the data gathered during site visits and field inspections to select, analyze savings, estimate cost and evaluate economic criteria for energy conservation opportunities. Section 2.0 of this report provides illustration of the existing energy situation at each site based on the available information provided by the Community. Energy conservation opportunities (ECOs) considered for selection, or reasons for their rejection are summarized in Section 3.0 of this report. These ECO's are derived from the Army Facilities Energy Plan, community suggestions, and experience on other projects. Section 4.0 of this Executive Summary briefly describes the various energy conservation projects developed as a result of our analysis. Three types of projects were identified including ECIP project, energy conservation projects to be funded though the use of Form 4283's and Increment F projects. No projects meeting the qualifications for Increment G were identified (see Section 1.3.1.4).

Section 5.0 of this Summary addresses the impact on energy consumption of implementing the various energy conservation project.

1.5 Phase II Methodology:

1.5.1 Objectives: The primary end product of EEAP Phase II is a consolidated list of architectural, mechanical, and electrical modification projects which will result in a reduction of energy consumption. The list includes estimated construction cost and energy saved for each project along with appropriate economic indicators (SIR) as dictated by ECIP criteria. The list is arranged in order of best (largest) SIR. From this list, Community and Corps of Engineers personnel will coordinate selection of projects for preparation of funding documents (Form 1391, PDBs) and the time frame for execution of those projects. Funding documents will be prepared for those selected projects as a part of Phase III of the EEAP program.

1.5.2 Methodology: The Phase II analysis was accomplished using the following six basic steps:

Step 1 - Prepare a master list of energy conservation opportunities (ECO) for buildings and utility systems based on Phase I experience and the list of ECOs included in the Army Facilities Energy Plan.

Step 2 - For each building and utility system at each installation, select those ECOs from the master list which are applicable according to the Phase I survey data.

Step 3 - Calculate energy savings for each ECO/building/system combination. The calculation process uses a combination of computerized and manual methods. Manual methods are used where the ECOs are simple

and are not affected by other ECOs. Computer analysis is used for building ECOs where many interrelated factors affect the results. The computer analysis consists of a base-line and modified analysis. The base-line run is based on existing conditions and operations. Subsequent runs simulate performance after the energy conservation project under study is implemented. The difference between those runs are the savings estimated for that ECO.

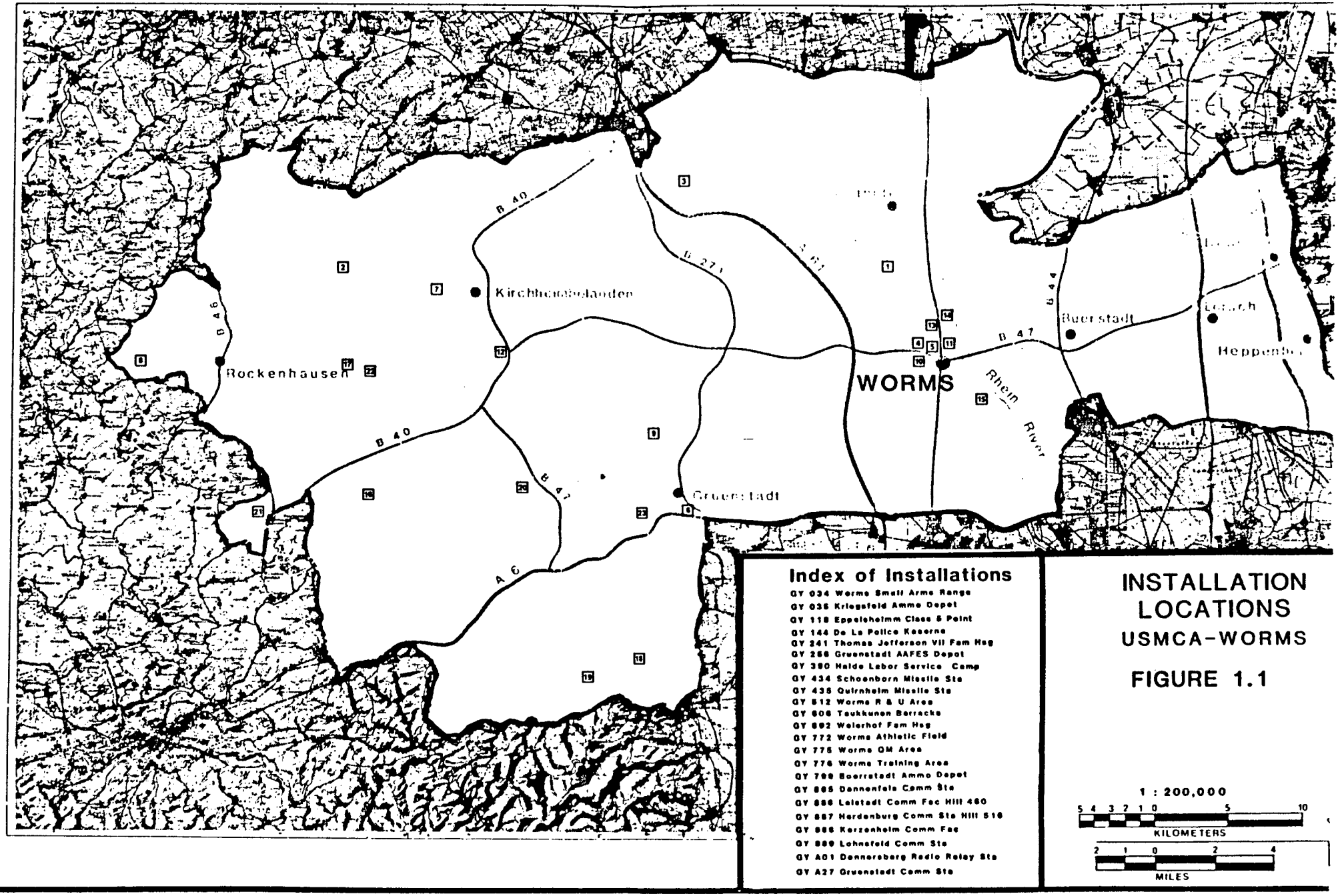
Step 4 - Calculate the cost to implement each ECO selected for each building. General unit cost have been developed from manufacturer's quotes and contracting experience provided by Lameyer International. Those unit costs are multiplied times the quantity of occurrences in a building or system to compute the total installation cost. All costs in the Phase II analysis are based on FY84 prices. After projects are selected and scheduled following Phase II, the cost will be escalated and updated to the time at which the project is finally scheduled.

Step 5 - Based on the savings and cost identified in Steps 3 and 4, economic analysis as defined in ECIP criteria is performed. Economic parameters include Total Discounted Savings, and SIR. These are summarized in a table and listed in order based on SIR.

Step 6 - A suggested packaging scheme for combining individual ECOs for individual buildings into projects is prepared. The packaging could be based on installation (i.e., all work in the Taukkunen installation) or type (i.e., all roof insulation on pitched roofs), or, most likely, some combination of installation, type work, and energy savings (SIR).

1.6 Phase III Preparation:

As previously stated, Phase III of the EEAP program consists of preparation of funding documents (Form 1391 and Project Development Brochures). These documents will be prepared based on the government comments returned on this report submittal. Prior to beginning work on Phase III, it is requested that the latest criteria for preparation of these programming documents be furnished. Criteria furnished at the beginning of this project may have changed and the latest version should be used to avoid unnecessary modifications and changes after the Phase III submittal.


B 40
B 271
B 47
B 44
B 46
A 6
Kirchheimbolanden
Rockenhausen
WORMS
Rhein River
Grunstadt
Buerstadt
Lorsch
Heppenh
Index of Installations
GY 034 Worms Small Arms Range
GY 035 Kriegsfeld Ammo Depot
GY 118 Eppelsheimm Class 6 Point
GY 144 De La Police Kaserne
GY 241 Thomas Jefferson Vil Fam Hsg
GY 256 Gruenstadt AAFES Depot
GY 390 Halde Labor Service Camp
GY 434 Schoenborn Missile Sta
GY 435 Quirnheim Missile Sta
GY 512 Worms R & U Area
GY 606 Taukkunen Barracks
GY 692 Welerhof Fam Hsg
GY 772 Worms Athletic Field
GY 775 Worms QM Area
GY 776 Worms Training Area
GY 799 Boerrstadt Ammo Depot
GY 885 Dannenfels Comm Sta
GY 886 Leistadt Comm Fac Hill 460
GY 887 Hardenburg Comm Sta Hill 516
GY 888 Kerzenheim Comm Fac
GY 889 Lohnsfeld Comm Sta
GY A01 Donnersberg Radio Relay Sta
GY A27 Gruenstadt Comm Sta
INSTALLATION LOCATIONS
USMCA-WORMS
FIGURE 1.1
1 : 200,000
5 4 3 2 1 0 5 10
KILOMETERS
2 1 0 2 4
MILES

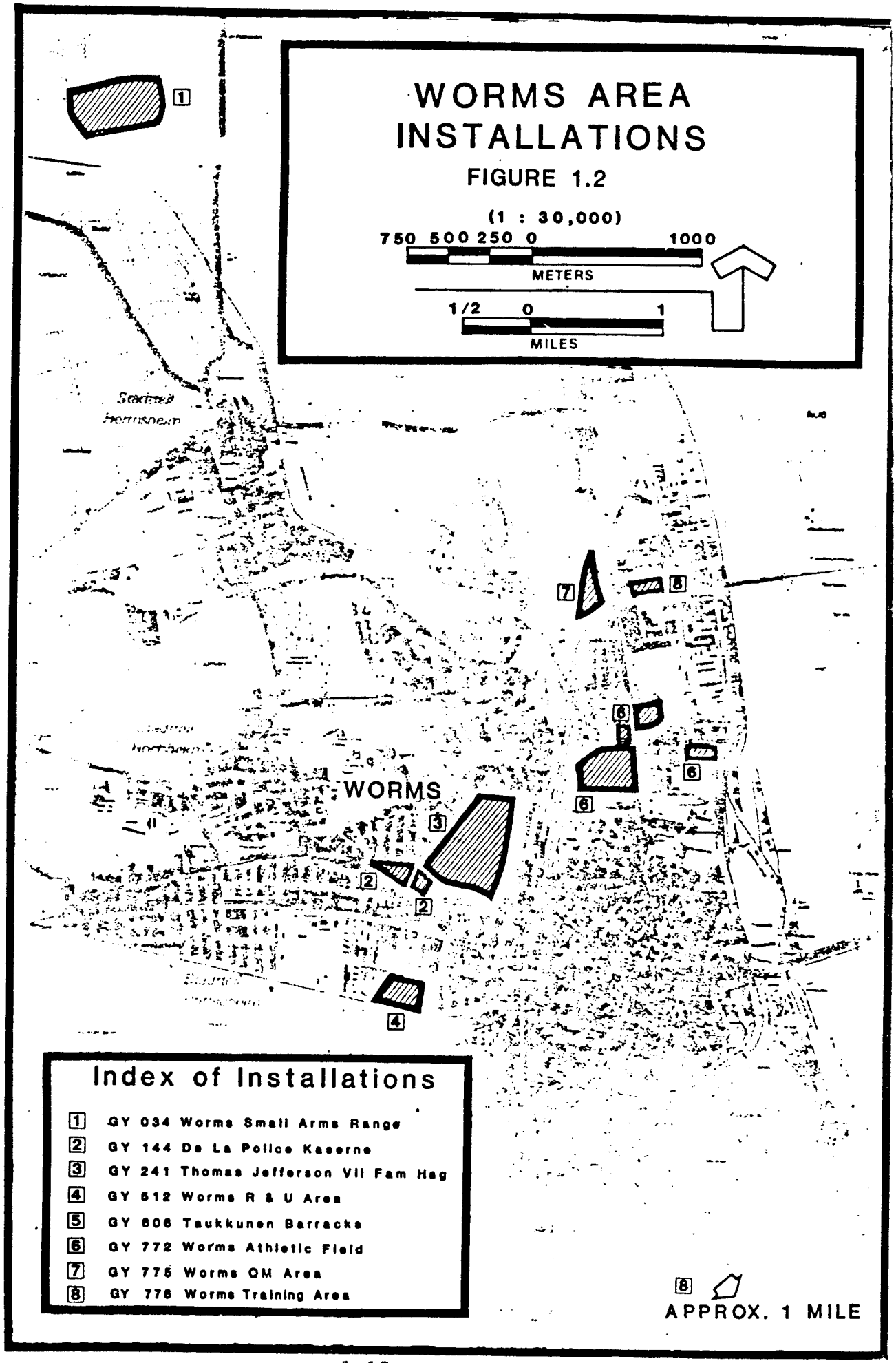

WORMS AREA INSTALLATIONS
FIGURE 1.2
(1 : 30,000)
750 500 250 0 1000
METERS
1/2 0 1
MILES
WORMS
Index of Installations
1 GY 034 Worms Small Arms Range
2 GY 144 De La Police Kaserne
3 GY 241 Thomas Jefferson VII Fam Hsg
4 GY 512 Worms R & U Area
5 GY 606 Taukkunen Barracks
6 GY 772 Worms Athletic Field
7 GY 775 Worms QM Area
8 GY 776 Worms Training Area
8 APPROX. 1 MILE

Figure 1.3 Worms Community Installations Omitted from Survey

GY 034 Worms Small Arms Range - Converted explosive storage facility with little or no energy consumption.

GY 118 Eppelsheim Class V Point - Ammunition magazines only.

GY 772 Worms Athletic Field - No field lighting or other energy consumption.

GY 776 Worms Training Area - No energy consuming facilities.

GY 799 Boerrstadt Ammo Depot - Ammunition storage only.

GY 886 Leistadt Communication Facility - Run by German Army.

GY 888 Kerzenheim Communication Facility - One small building with little potential for energy conservation.

FIGURE 1.4 - INSTALLATIONS SURVEYED IN WORMS MILITARY COMMUNITY

INSTAL. NO.	NAME OF INSTALLATION	LOCATION	FACILITY NO.
GY 35	KRIEGSFELD AMMO DEPOT	KRIEGSFELD	10002 - 10169
GY 144	DE LA POLICE KASERNE	WORMS	5900 - 5912
GY 241	TOM JEFFERSON VIL.FAM.HSG.	WORMS	5000 - 5041
GY 256	GRUENSTADT EES FAC.	GRUENSTADT	3550 - 3571
GY 390	HAIDE CIVILIAN SERV. TROUPS	HAIDE/KIB	3451 - 3480
GY 434	SCHOENBORN MISSILE STA.	SCHOENBORN	11601 - 11671
GY 435	QUIRNHEIM MISSILE STA.	QUIRNHEIM	11503 - 11575
GY 512	WORMS R & U AREA	WORMS	5949 - 5956
GY 606	TAUKKUNEN BARRACKS	WORMS	5801 - 5937
GY 692	WEIERHOF FAM. HSG.	WEIERHOF/KIB	3967 - 4000
GY 775	WORMS QM AREA	WORMS	5930
GY 885	DANNENFELS COMM STA	DANNENFELS	2450 - 2457
GY 887	HARDENBURG COMM. STA.	HARDENBURG	2480 - 2487
GY 889	LOHNSFELD COMM. STA.	LOHNSFELD	2490 - 2491
GY A01	AUSTIN RADIO RELAY STA.	DANNENFELS	2522 - 2526
GY A27	GRUENSTADT COMM. STA.	GRUENSTADT	3601 - 3624

FIGURE 1.5 - BUILDINGS SURVEYED IN WORMS MILITARY COMMUNITY
KRIEGSFELD AMMO DEPOT GY 35

BLDG NO	DESIGNATION	GROSS SQ FT	
10002	R & U SHOP	1,582	
10005	BN HQ BLDG	15,206	
10007	MOTOR REP SHOP	6,240	
10008	ENL PERS MESS	7,142	
10009	EM BK W/O MS	21,083	DETAILED SURVEY BUILDING
10010	MOTOR REPAIR	4,689	
10011	MAINTENANCE CTR	4,294	
10016	EM BK W/O MS	7,007	
10019	SKILL DEV CEN	2,023	
10043	DOG KENNEL		
10148	EDUCATION CENTER		
10150	EM BK W/O MS	24,358	
10151	LIBRARY	2,811	
10152	THEAT W/STAGE	5,777	
10153	FIRE STATION	3,305	
10154	OPEN MESS NCO	6,192	
10155	EXCH CAFE	4,345	
10156	GYMNASIUM	8,047	
10157	BOWLING CENTER	3,553	
10159	LEARNING CENTER	1,440	
10163	READY BLDG	6,395	
10164	HEATING PL OIL	249	MECHANICAL SURVEY ONLY
10166	OPS GEN PURP	3,182	
10167	SHOP, SUPPLY OFF.	1,426	
10168	STORAGE	2,146	
10169	AMMO RENV SHOP	5,489	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
DE LA POLICE KASERNE, GY 144

BLDG NO	DESIGNATION	GROSS SQ FT
5900	ADM GEN PURP	11,070
5904	GEN PURP WHS	18,654
5906	DEPN GRADE SCH	4,212
5907	SUP SVC ADM BLDG	1,858
5909	EM BK W/O MS	14,206
5910	ELEC MNT SHOP	3,202
5911	DISPATCH OFFICE	396
5912	DEPN GRADE SCH	6,411

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
THOMAS JEFFERSON VIL FAM HSG, GY 241

BLDG NO	DESIGNATION	GROSS SQ FT	
5000	FH FGN NCO	29,230	DETAILED SURVEY BUILDING
5001	FH FGN NCO	29,368	
5002	FH FGN NCO	29,368	
5004	FH FGN NCO	29,885	
5005	FH FGN NCO	43,510	DETAILED SURVEY BUILDING
5006	FH FGN NCO	29,357	
5007	FH FGN NCO	43,510	
5008	FH FGN NCO	29,357	
5009	FH FGN NCO	42,558	
5010	COMMISSARY	27,479	DETAILED SURVEY BUILDING
	EXCH MAIN RETL	12,570	
5011	EXCH SP SPT FAC	2,412	
5012	FH FGN NCO	37,011	
5013	FH FGN LC & MAJ	11,825	
5014	FH FGN COL	4,561	
5015	DEPN GRADE SCH	19,856	DETAILED SURVEY BUILDING
5017	FH FGN NCO	20,143	
5018	FH FGN NCO	20,143	
5019	FH FGN NCO	20,143	
5020	FH FGN NCO	20,143	DETAILED SURVEY BUILDING
5021	FH FGN NCO	13,767	
5022	FH FGN NCO	13,767	
5023	FH FGN NCO	16,492	
5024	FH FGN NCO	16,492	
5026	FH FGN NCO	36,997	
5027	FH FGN LC & MAJ	37,011	
5028	YOUTH CENTER	7,022	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
THOMAS JEFFERSON VIL FAM HSG, GY 241

BLDG NO	DESIGNATION	GROSS SQ FT	
5029	FH FGN LC & MAJ	37,011	
5030	FH FGN LC & MAJ	37,011	
5031	OPEN MESS OFF	7,915	DETAILED SURVEY BUILDING
5032	BOQ MIL MALE	12,282	DETAILED SURVEY BUILDING
5033	BOQ MIL MALE TRN	13,501	
5034	DEPN GRADE SCH	960	
5035	DEPN GRADE SCH	960	
5036	DEPN GRADE SCH	960	
5037	DEPN GRADE SCH	960	
5038	DEPN GRADE SCH	960	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
GRUENSTADT AAFES DEPOT GY 256

BLDG NO	DESIGNATION	GROSS SQ FT	
3550	MTL & WDWK SH	9,471	
	EXCH ADM BLDG	6,435	
3551	GEN PURP WHSE	5,247	
3553	MTL & WDWK SH	8,883	
3555	COLD STOR WHS	19,871	DETAILED SURVEY BUILDING
	MEAT CUT PLANT	12,569	
	CON HUM WHS	6,850	
	GEN PURP WHSE	193,832	
	EXCH ADM BLDG	8,115	
	BAKERY		
3556	RED CROSS BLDG	8,606	
	HEATING PL OIL	5,321	MECHANICAL SURVEY ONLY
	DISPATCH OFFICE	1,549	
	GEN PURP WHSE	24,675	
3557	DISPATCH OFFICE	3,211	
3559	MEAT CUT PLANT	27,962	
3559A	COLD STOR WHS	4,854	
3566	GEN PURP WHSE	9,716	
3568	EXCH SVC STA	620	
3570	MOTOR REP SHOP	9,853	
3571	COLD STOR WHS	6,811	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
HAIDE LABOR SERVICE CAMP, GY 390

BLDG NO	DESIGNATION	GROSS SQ FT
3451	OPEN MESS OFF	928
3459	DISPATCH OFFICE	304
3471	VEHICLE STORAGE	743
3472	MOTOR REP SHOP	1,044
3473	EM BK W/O MS	1,585
3474	BOQ MIL MALE	1,585
3479	EM BK W/O MS	5,530
3480	EM BKS W/MESS	17,294

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
SCHOENBORN MISSILE STA, GY 434

BLDG NO	DESIGNATION	GROSS SQ FT	
11601	READY BLDG	1,850	
11602	HEATING PL OIL	1,742	MECHANICAL SURVEY ONLY
11605	MSL ASSY & TEST	1,634	
11612	MSL LCH & STR	4,516	
11613	SAFE HOUSE	355	
11617	MSL LCH & STR	4,516	
11618	SAFE HOUSE	355	
11627	MSL LCH & STR	4,516	
11634	COMM. SHOP	787	
11654	HEATING PL OIL	2,024	MECHANICAL SURVEY ONLY
11655	EM BKS W/MESS	21,337	DETAILED SURVEY BUILDING
11657	MOTOR REP SHOP	1,930	DETAILED SURVEY BUILDING
11662	GEN PURP WHSE	1,005	
11663	RECR BLDG	2,520	
11670	OPS GEN PURP	443	
11671	READY BLDG	920	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
QUIRENHEIM MISSILE STA., GY 435

BLDG NO	DESIGNATION	GROSS SQ FT	
11503	CO HQ BLDG	3,393	
11505	BOQ MIL MALE	3,482	
11510	MOTOR REP SHOP	1,930	
11514	HEATING PL OIL	2,022	MECHANICAL SURVEY ONLY
11515	ENL PERS MES	3,168	
11516	RECR BLDG	2,520	
11518	EM BK W/O MS	3,470	
11520	EM BK W/O MS	3,470	
11522	EM BK W/O MS	3,470	
11534	HEATING PL OIL	1,575	MECHANICAL SURVEY ONLY
11536	READY BLDG	1,850	
11538	MSL ASSY & TEST	1,634	
11542	MSL WARHD BLDG	787	
11543	READY BLDG	6,395	
11552	SAFE HOUSE	355	
11554	MSL LCH & STR	4,517	
11558	SAFE HOUSE	355	
11560	MSL LCH & STR	4,517	
11565	MSL LCH & STR	4,517	
11567	SAFE HOUSE	355	
11573	OPS GEN PURP	442	
11575	READY BLDG	1,139	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
WORMS R&U AREA, GY 512

BLDG NO	DESIGNATION	GROSS SQ FT	
5949	MOTOR REP SHOP	5,838	
5950	WAREHOUSE	7,345	
5950A	WAREHOUSE	24,564	
5953	FLAM MAT STHS	5,376	
5954	FE MNT SHOP	11,374	DETAILED SURVEY BUILDING
5956	ENGR ADM BLDG	2,474	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
TAUKKUNEN BARRACKS, GY 606

BLDG NO	DESIGNATION	GROSS SQ FT	
5801	EM BK W/O MS	47,275	
5802	EM BK W/O MS	28,578	
5803	ROD-GUN CLUB	4,432	
5804	GEN STOREHOUSE	11,849	DETAILED SURVEY BUILDING
5805	EXCH MNT SHOP	7,265	
5806	COMM CENTER	7,620	
5807	EAM BLDG	7,249	DETAILED SURVEY BUILDING
5808	ADM GEN PURP	1,479	
	COMMUNITY CENTER	18,557	
5810	PO MAIN	2,906	
5813	ADM GEN PURP	46,392	
5814	ARMY HQ BLDG	9,531	
5815	ADM GEN PURP	45,585	DETAILED SURVEY BUILDING
5816	ADM GEN PURP	46,995	
5817	ADM GEN PURP	50,207	
5818	OTHER	1,108	
5819	UNIT CHAPEL	5,595	
5820	HEATING PL OIL	5,629	MECHANICAL SURVEY ONLY
5821	DISP W/O BEDS	20,117	DETAILED SURVEY BUILDING
5822	ADM GEN PURP	22,081	
5824	EM SERVICE CLUB	28,444	
	ADM GEN PURP	8,050	
5825	EXCH MAIN RETL	11,548	DETAILED SURVEY BUILDING
5826	THEAT W/STAGE	11,263	DETAILED SURVEY BUILDING
5827	GEN STOREHOUSE	7,157	
5828	EW BK W/O MS	22,081	
5829	ADM GEN PURP	21,130	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
TAUKKUNEN BARRACKS, GY 606

BLDG NO	DESIGNATION	GROSS SQ FT	
5831	ENL PERS MESS	35,192	
5832	BN HQ BLDG	10,391	
	EM BK W/O MS	26,187	
5834	ADM GEN PURP	9,478	DETAILED SURVEY BUILDING
5836	OPEN MESS NCO	6,769	
5837	BOWLING CENTER	6,142	DETAILED SURVEY BUILDING
	GYMNASIUM	18,346	
5838	OPS GEN PURP	3,508	
5839	MOTOR REP SHOP	15,574	DETAILED SURVEY BUILDING
5841	G M MNT FACILITY	12,882	
5842	HEATING PL OIL	2,508	MECHANICAL SURVEY ONLY
5937	AUTO S H GARAGE	6,797	

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
WEIERHOF FAM HSG, GY 692

BLDG NO	DESIGNATION	GROSS SQ FT
3967	DEPN KGRTN SCH	2,097
3967A	YOUTH CENTER	825
3968	GEN STOREHOUSE	1,582
3969	MTL & WDWK SH	1,877
3970	FE MNT SHOP	1,582
3971	ROD-GUN CLUB	791
3974	MTL & WDWK SH	791
3976	SENTRY STATION	791
3977	FH FGN NCO	29,885
3979	LAUNDRY	
3981	POST CHAPEL	1,991
3986	AUTO S H GARAGE	2,486
	THEAT W/STAGE	3,370
3989	FH FGN CG & WO	25,146
3990	BOQ MIL MALE TRN	5,934
3991	DISP W/O BEDS	2,045
3992	FH FGN NCO	37,266
3993	FH FGN NCO	37,266
3994	DEPN GRADE SCH	8,076
3995	FH FGN CG & WO	37,266
3996	FH FGN NCO	25,152
3997	DISP W/O BEDS	2,160
3998	RACQUET BALL CT	
4000	CHILD CARE	2,135

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
WORMS QM AREA, GY 775

BLDG NO	DESIGNATION	GROSS SQ FT
5930	GEN PURP WHS	14,438

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
DANNENFELS COMM STA., GY 885

BLDG NO	DESIGNATION	GROSS SQ FT	
2450	ADM GEN PURP	2,009	DETAILED SURVEY BUILDING
2451	COMM CENTER	3,756	
2452	TERM EQP BLDG	10,543	
2455	HEATING PL OIL	355	MECHANICAL SURVEY ONLY

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
HARDENBURG COMM STA HL516, GY 887

BLDG NO	DESIGNATION	GROSS SQ FT
2480	ENL PERS MESS	1,092
2481	COMM CEN BLDG	405
2482	COMM CENTER	546
2485	COMM CEN BLDG	1,052
2486	EM BK W/O MS	2,107
2487	EM BK W/O MESS	1,100

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
LOHNSFELD COMM STA., GY 889

BLDG NO	DESIGNATION	GROSS SQ FT
2490	EM BKS W/MESS	5,584
2491	RECVR BUILDING	4,711

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
AUSTIN RADIO RELAY STATION, GY A01

BLDG NO	DESIGNATION	GROSS SQ FT
2522	COMM CEN BLDG	1,399
2523	RECR BLDG	1,200
2526	EM BKS W/MESS	2,990

FIGURE 1.5 CONT. - WORMS MILITARY COMMUNITY
GRUENSTADT COMM STA GY A27

BLDG NO	DESIGNATION	GROSS SQ FT	
3601	LATRINE	900	
3603	RECR. BLDG	3,800	
3604	HEATING PL OIL	1,901	MECHANICAL SURVEY ONLY
3605	EM BK W/O MS	3,241	
3609	ELEC MNT SHOP	2,260	
3616	ADMIN BLDG	671	
3624	BARRACKS W/O MESS	880	

2.0 EXISTING ENERGY SITUATION

2.1 Background:

One of the requirements of the EEAP program is to examine the existing energy situation at each site where an EEAP study is performed. There are several reasons this effort is included. One of the prime motivations is the Army Facilities Energy Plan objective to reduce energy usage by 20 percent by the year FY85 in comparison to a base year of FY75. In an EEAP study, one of the objectives is to identify the base year (FY75) consumption and compare the current energy situation to that value. Based on this comparison, some judgement can be made as to additional effort required in terms of new construction projects to allow reductions to meet the goal.

In addition to comparison with the FY85 energy goal, examination of the existing energy situation can provide an indication of the relative importance of each type or component of energy consumption. For example, by comparing how much energy is used for heating versus the consumption for domestic water heating, the study may establish priorities for those items which have the greatest potential for energy savings. One difficulty which arises in performing this type of analysis is the general lack of sub-metering data of a particular installation's energy consumption. Since most Army facilities were constructed during a time when energy costs were relatively unimportant, very little emphasis in the past has been placed on actual metering of energy usage for a particular function. For example, it's impossible in most cases to examine actual metered data of individual building's energy consumption within a facility or the usage of energy for different activities within a building. Since this

metered data is not available, engineering estimates have to be made to determine the data.

A third objective in examining the existing energy situation at a facility is to provide an overview prior to the detailed point by point energy conservation opportunity evaluation. Because the detailed analysis is so voluminous, it's easy to lose track of the objective of the EEAP program.

2.2 General Description:

All Worms Military Community sites utilize electricity purchased from local electric utilities. These utility companies then bill the U.S. Army for the energy consumed at each installation. The price of electricity varies for each installation with the total cost of electricity composed of charges for kilowatt - hour (KWH) and kilowatt (KW) demand.

Electricity is utilized for a variety of tasks including lighting, operation of heating system distribution equipment, and office and household equipment. Data processing and communications equipment with its associated mechanical coding systems also consume electricity.

Fossil fuels including coal, oil (number 2 and 6), and natural gas are consumed to provide space heating, domestic hot water and process steam. While space heating accounts for the major fraction of fossil fuel energy consumed at most installations, housing areas, troop billets, and mess halls use large quantities of domestic hot water and heat for food preparation.

The Gruenstadt AAFES Depot houses a large bakery, ice cream manufacturing plant, and meat processing plant.

Each of these industries consume process energy including electricity for refrigeration, steam for domestic hot water generation and process heating, and natural gas in direct fired ovens.

2.3 Energy Consumption Components:

As discussed earlier, no detailed sub-metering data is available for the sites to provide a break down of energy consumption by component. Computer modeling and engineering estimating techniques have been used to assess constituent energy consumption.

2.4 Utility Metering:

2.4.1 Electricity:

The majority of sites in the Worms Military Community receive electricity through and are billed from one revenue meter. Sites such as Taukkunen Barracks which have more than one revenue meter do not bill activities within the site separately, and thus no advantage exists for the use or installation of additional sub-meters. Some family housing units at Thomas Jefferson Village contain individual apartment electric meters; however, Army policy prohibits charging occupants with monthly utility costs. Consequently, their use can only be for evaluating the effectiveness of energy conservation programs. Additional metering as part of an electrical demand control system may be advantageous.

2.4.2 Fuels:

Records of monthly coal and fuel oil usage are recorded for each boiler plant. Natural gas is

metered at each building with gas service. The installation of additional metering devices would be quite expensive and is not recommended.

2.5 Electrical Energy:

2.5.1 Information on Electrical Energy Consumption in total kilowatt hours and kilowatt demand was requested for fiscal years 1981, 1982, and 1983, as well as data for fiscal year 1975, which is to serve as the base for comparison of energy conservation goals. This data is contained in the PHASE I DATA REPORT and presented in both tabular and graphic forms. Refer to Section 2.7, Total Energy Consumption and Figures 2.3 through 2.18 for a representation of energy consumption by installation and year.

2.5.2 The price of electricity varies for each installation in the Worms Community. The total cost of electricity is composed of charges for kilowatt-hour (KWH) consumption, kilowatt (KW) demand, and power factor correction. The price per KWH paid varies depending on the season (Summer versus Winter) and time of usage (normal versus off-peak). No installation currently pays for power factor correction. At the time of the field survey, De La Police Kaserne had a low power factor averaging .83. It has since been corrected. Charges for each component of the electric bill for each installation is included in Figure 2.1 as of Jan. '84. Also included in this figure is the average total price per KWH for each installation. Figure 2.2 lists electric energy costs in Deutsch Marks per million BTUs (DM/MBTU) and dollars per million BTUs ($/MBTU).

2.6 Fuels

2.6.1 Several types of Fossil Fuels are utilized for providing space heating, domestic hot water, and process steam. These include natural gas, coal, and fuel oil (both number 2 and number 6). Consumption of heating fuels by installation are included in the PHASE I DATA REPORT. This information is presented in tabular and graphic form for each fuel for each fuel type used by each installation. Refer to Section 2.7, Total Energy Consumption and Figures 2.3 through 2.18 for a representation of energy consumption by installation and year.

2.6.2 Prices for oil, natural gas, and coal were obtained from the Utilities Branch of Facilities Engineering in Worms and from the USAREUR Energy Center in Rheinau, Germany. These prices are listed below.

Number 2 Fuel Oil = $.5109 DM/Liter, Worms
$.5207 DM/Liter, Weierhof

Number 6 Fuel Oil = $.48093 DM/Kg., Gruenstadt

Natural Gas = 126.00 DM/Year, Meter Charge
+ .9130 DM/Cubic Meter, Worms

Coal:

Anthracite	Stove	=	$115.14/Metric Ton
Anthracite	Nut	=	$112.51/Metric Ton
Anthracite	Pea	=	$ 99.52/Metric Ton
Bituminous	High Vol	=	$ 69.00/Metric Ton
	Medium	=	$ 70.87/Metric Ton

Transportation Changes = $33.70/Metric Ton, Anthracite
= $37.20 Metric Ton, Bituminous

These energy costs were converted into the units Deutsch Marks per Million BTUS (DM/MBTU) for use in the economic analysis.

To accomplish this the following energy conversion factors obtained from the ECIP Guidance Criteria dated Feb. 18, 1983 were used:

1 KWH Electricity	=	11,600 BTU
1 Gallon #2 Oil	=	138,700 BTU
*1 Gallon #6 Oil	=	150,000 BTU
1000 FT^3 Natural Gas	=	1,031,000 BTU
1 Short Ton Anthracite Coal	=	25,400,000 BTU
1 Short Ton Bituminous Coat	=	24,580,000 BTU

*This conversion factor was taken from NAVFAC ECIP Guide dated Feb. 1983.

Using these factors and metric conversions, the following energy costs were calculated:

Anthracite (stove) Coal	= 14.885 DM/MBTU	= $5.907/MBTU
Bituminous (medium) Coal	= 11.168 DM/MBTU	= $4.432/MBTU
Number 2 Fuel Oil (Worms)	= 13.942 DM/MBTU	= $5.533/MBTU
(Weierhof)	= 14.209 DM/MBTU	= $5.638/MBTU
Number 6 Fuel Oil (Worms)	= 11.788 DM/MBTU	= $4.678/MBTU
Natural Gas	= 25.076 DM/MBTU	= $9.951/MBTU

Note: MBTU = 1 MILLION BTU's = 10^6 BTU.
$1.00 = 2.52 DM

Energy Savings and economic calculations were performed using these prices and data on the energy source used in each building as determined during the PHASE I survey.

2.7 Total Energy Consumption:

As part of the PHASE I Data Report, all quantities of each form of energy consumed by each facility were converted to BTUs. These are presented graphically in the figures of Section 7 of the Data Report. Graphs depicting monthly energy consumption by energy type and graphs illustrating total annual energy consumption were included. These annual energy consumption graphs and an analysis of the percent change in energy consumption for each form of energy used in fiscal years 1975, 1980, 1981, 1982, and 1983 for each installation are reproduced in Figures 2.3 through 2.19. In creating these graphs of total energy consumption in BTUs, the energy conversion factors from the ECIP Guidance Criteria listed above were used.

2.8 Energy Consumption Analysis:

Examining these graphs and figures, several trends become evident. At most installations, consumption of electricity and fuels peak during the winter months. These peaks suggest that heating and its associated auxiliary loads are a major energy use and a prime target for energy conservation efforts. During the summer months, fuels are used for domestic hot water heating and process loads. With mechanical cooling used in only a small number of installations, summer electrical use is generally composed of a base load of lights and equipment. Note, however, at Gruenstadt AAFES Depot, that where a great deal of mechanical refrigeration equipment is used, electrical consumption peaks during the summer months. Administrative areas such as Taukkunen Barracks that use air conditioning and

have a high appliance equipment load exhibit a smaller seasonal variation.

The general trend from fiscal year 1975 to present shows an increase in consumption of electrical energy. This increase is due in part to a growing community population and to the increase in use of equipment including data processing centers and office appliances. Fuel consumption at most installations has declined due to community energy conservation efforts. Increases at other communities may be attributed to an expansion or change in the mission performed at that site.

2.9 Summary:

Through the examination of historic energy consumption data, it is evident that space heating and its associated auxiliary loads are the major energy user. Energy conservation efforts directed at reducing heat loss through building envelope modification and improving heating system efficiency offer great potential for savings as illustrated in this report. Other key areas for energy conservation include the reduction of heating plant usage during summer months by reducing domestic hot water loads and trimming electrical consumption by improving component efficiencies and equipment control.

FIGURE 2.1 ELECTRIC RATES

GY AREA/INSTALLATION	ELECTRICAL DEMAND[1] CONTRACT	MAXIMUM	MINIMUM	KW INCREMENT/CHARGES			ELECTRICAL CONSUMPTION[2] NORMAL		OFF-PEAK		TOTAL[3] AVERAGE COST
(035) KRIEGSFELD	370 KW	370 KW	278 KW	First 300 KW 276.82	Next 700 KW 209.62	Next 2000 KW 184.55	SUMMER 12.86	WINTER 13.89	SUMMER 8.27	WINTER 7.89	.1447
(144) DE LA POLICE KASERNE	75 KW	90 KW	53 KW				0-240,000 KWH 19.81 NEXT 2,760,000 KWH 18.23 REST 16.66		11.71 10.00 9.90		.1984
(241) THOMAS JEFFERSON VILLAGE	650 KW	780 KW	344 KW				0-240,000 KWH 16.07 NEXT 600,000 KWH 14.13 NEXT 396,000 KWH 12.18 REST 11.02		9.50 8.28 7.06 6.58		.1433
(256) GRUENSTADT EES	2200 KW	2200 KW	1650 KW	First 300 KW 267.03	Next 700 KW 200.27	Next 2000 KW 178.02	SUMMER 12.11	WINTER 13.11	SUMMER 7.75	WINTER 7.89	.1386
(390) HAIDE CIV. SERV.	55 KW	65 KW	30 KW	FIRST 300 KW 220.50			16.00		10.28		.2093
(434) SCHOENBORN MISS. STA.	300 KW	300 KW	225 KW	First 100 372.94	Next 200 276.82	NEXT 100 242.22	12.86	13.89	8.27	7.89	HSG. .2056 LAUN. .1831
(435) QUIRNHEIM MISS. STA.	200 KW	200 KW	150 KW	FIRST 100 372.94	NEXT 200 276.82	NEXT 100 242.22	12.86	13.89	8.27	7.89	HSG. .2291 LAUN. .1798 CONT. .2394 WTR. .2129
(512) WORMS R&U AREA	30 KW	36 KW	21 KW				0-240,000 KWH 19.81 NEXT 2,760,000 KWH 18.23 REST 16.66		11.71 10.00 9.90		.2398
(606) TAUKKUNEN BARRACKS	700 KW	840 KW	490 KW	199.91 DM/MONTH			0-240,000 KWH 16.07 NEXT 600,000 KWH 14.13 NEXT 396,000 12.18 REST 11.20		9.50 8.28 7.06 6.58		.1440

FIGURE 2.1 ELECTRIC RATES

GY AREA/INSTALLATION	ELECTRICAL DEMAND[1] CONTRACT	MAXIMUM	MINIMUM	KW INCREMENT/CHARGES			ELECTRICAL CONSUMPTION[2] NORMAL	OFF-PEAK		TOTAL[3] AVERAGE COST
(692) WEIERHOF FAMILY HOUSING	200 KW	200 KW	150 KW	First 300 KW 276.82	Next 700 KW 207.62	Next 2000 KW 184.55	SUMMER 12.86	WINTER 13.89	SUMMER 8.27	WINTER 7.89	.1691
(775) WORMS QM AREA				157.55 DM/MONTH			15 PF/KWH				.2566
(885) DANNENFELS COMM.				NO INFORMATION OBTAINED							
(887) HARDENBURG COMM.	30 KW	30 KW	23 KW	.99 PF/KW			SUMMER 12.86	WINTER 13.89	SUMMER 8.27	WINTER 7.89	.1671
(889) LOHNSFELD COMM.	150 KW	150 KW	113 KW	First 300 KW 276.82	Next 700 KW 207.62	Next 2000 KW 184.55	12.86	13.89	8.27	7.89	.1577
(A01) AUSTIN RADIO	60 KW	60 KW	23 KW	First 100 372.94	Next 200 276.82	NEXT 100 262.22	12.86	13.89	8.27	7.89	.1573
(A27) GRUENSTADT COMM.	50 KW	50 KW	37.5 KW	FIRST 300 276.82	NEXT 700 207.62	NEXT 100 184.55	12.86	13.89	8.27	7.89	.1412

NOTES:

1. KW demand charges are given in DM/KW demand per year based on the average of the three highest months. If the average demand of the 3 highest months was 360 KW for Kriegsfeld then the demand charge = (300 x 276.82 DM) + (60 x 209.62 DM) = 92,623.20 DM/YEAR or 7,968.60 DM/MONTH

2. KWH consumption charges are given in PF/KWH for normal and off-peak hours for summer and winter seasons.

3. Total average cost equals total cost for electricity including all charges for demand consumption and power factor correction for 1 year divided by the total KWH consumption for that year. Figures are in DM/KWH.

ELECTRICITY

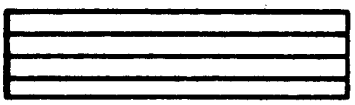
1 KWH : 11,600 BTU

#2 FUEL OIL

1 Gallon : 138,700 BTU

#6 FUEL OIL

1 Gallon : 150,00 BTU



NATURAL GAS

1 Cubic Meter : 36,410 BTU

COAL

1 Metric Ton (anth.) : 27,998,420 BTU

1 Metric Ton (bit.) : 27,094,534 BTU

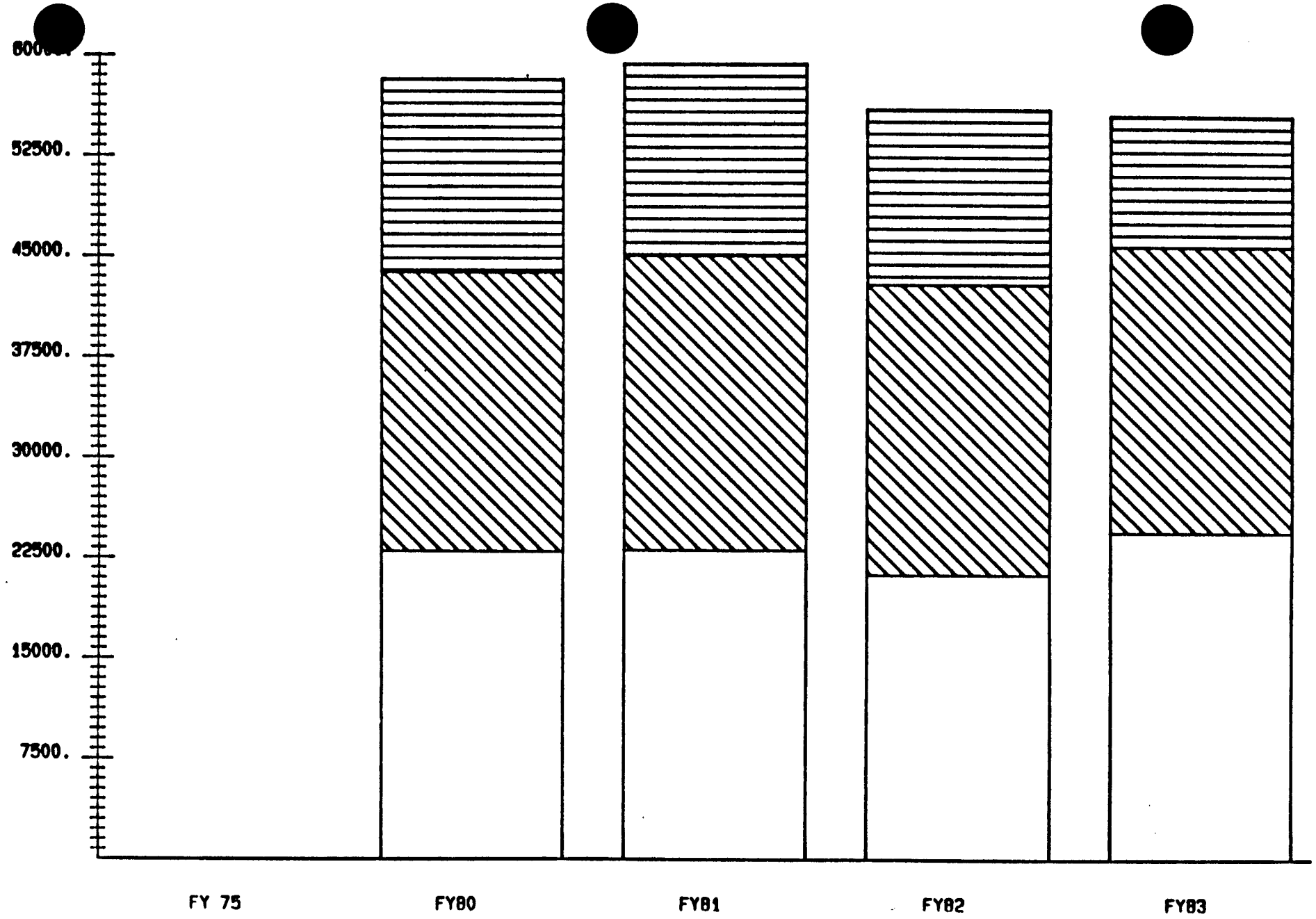
LEGEND - ENERGY CONSUMPTION GRAPHS

FIGURE 2.2 ELECTRIC ENERGY COSTS

AREA	USE	DM/KWH	DM/MBTU*	$/MBTU+
GY 035 Kreigsfeld	Billets	.0974	8.40	3.33
	Admin.	.1266	10.91	4.33
GY 144 De La Police	All Locations	.1779	15.34	6.09
GY 241 Tom Jeff Hsg.	Housing	.1344	11.59	4.60
GY 256 Gruenstadt AAFES	All Locations	.1169	10.08	4.00
GY 390 Haide Labor Serv.	All Locations	.1022	8.81	3.50
GY 434 Schoenborn	Billets	.1156	9.97	3.96
	Admin.	.1338	11.53	4.58
GY 435 Quirnheim	Billets	.1126	9.71	3.85
	Admin.	.1338	11.53	4.58
GY 512 Worms R&U	All Locations	.1657	14.28	5.67
GY 606 Taukkunen	All Locations	.1440	12.41	4.92
GY 775 Worms QM	All Locations	.1500	12.93	5.13
GY 692 Weierhof Hsg.	All Locations	.1073	9.25	3.67
GY 885 Dannenfels	All Locations	.1046	9.02	3.58
GY 887 Hardenburg	All Locations	.1671	14.41	5.72
GY 889 Lohnsfeld	All Locations	.1046	9.02	3.58
GY A01 Austin Radio	All Locations	.1046	9.02	3.58
GY A27 Gruenstadt Comm	All Locations	.1046	9.02	3.58

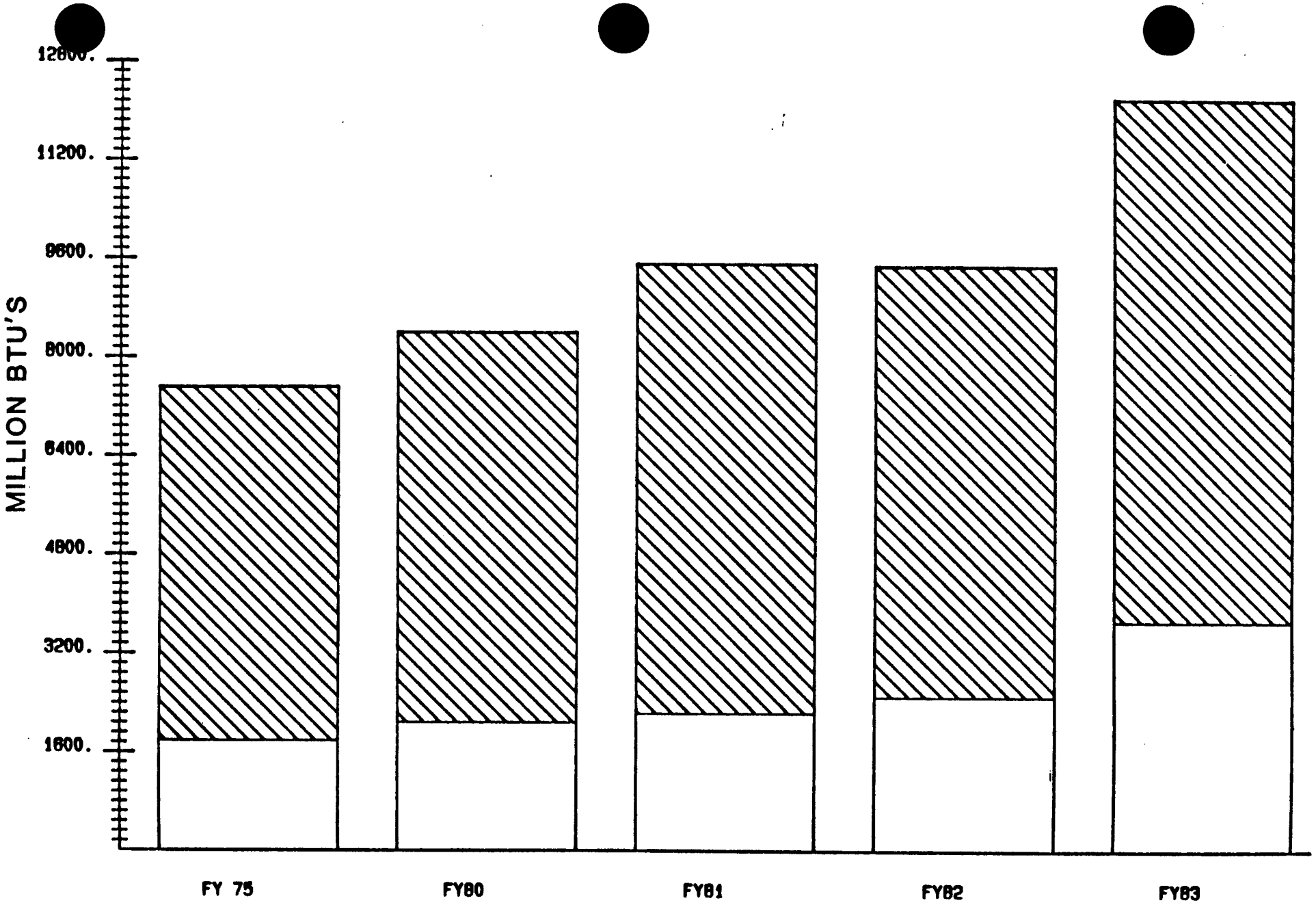
* 1 KWH = 11,600 BTU

+ 2.52 DM = $ 1.00



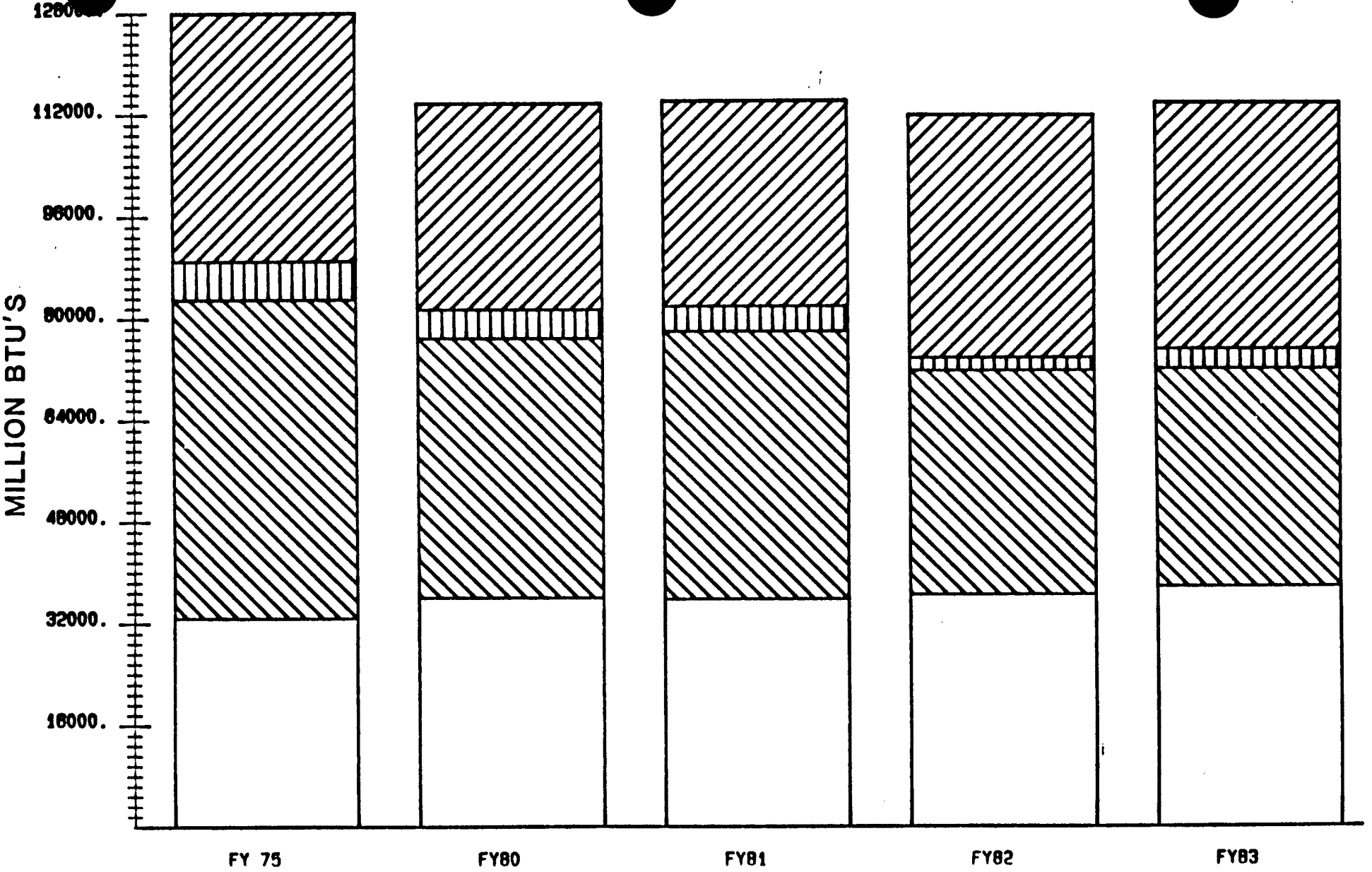
KRIEGSFELD AMMO DEPOT GY-035 TOTAL ENERGY CONSUMPTION,

FIGURE 2.3 Refer to Legend for Energy Type and BTU Equivalency



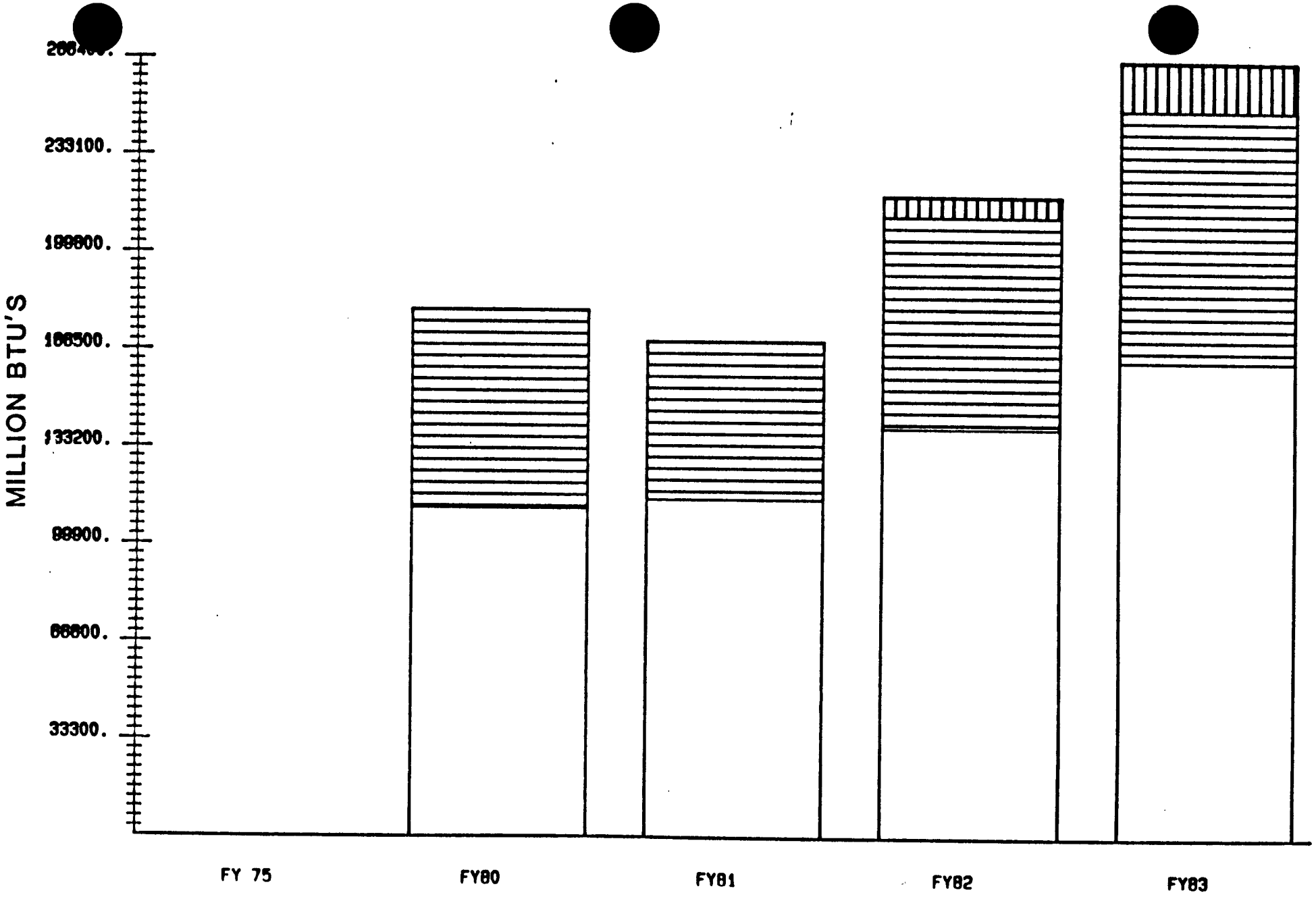
DE LA POLICE KASERNE GY-144 TOTAL ENERGY CONSUMPTION,

FIGURE 2.4 Refer to Legend for Energy Type and BTU Equivalency



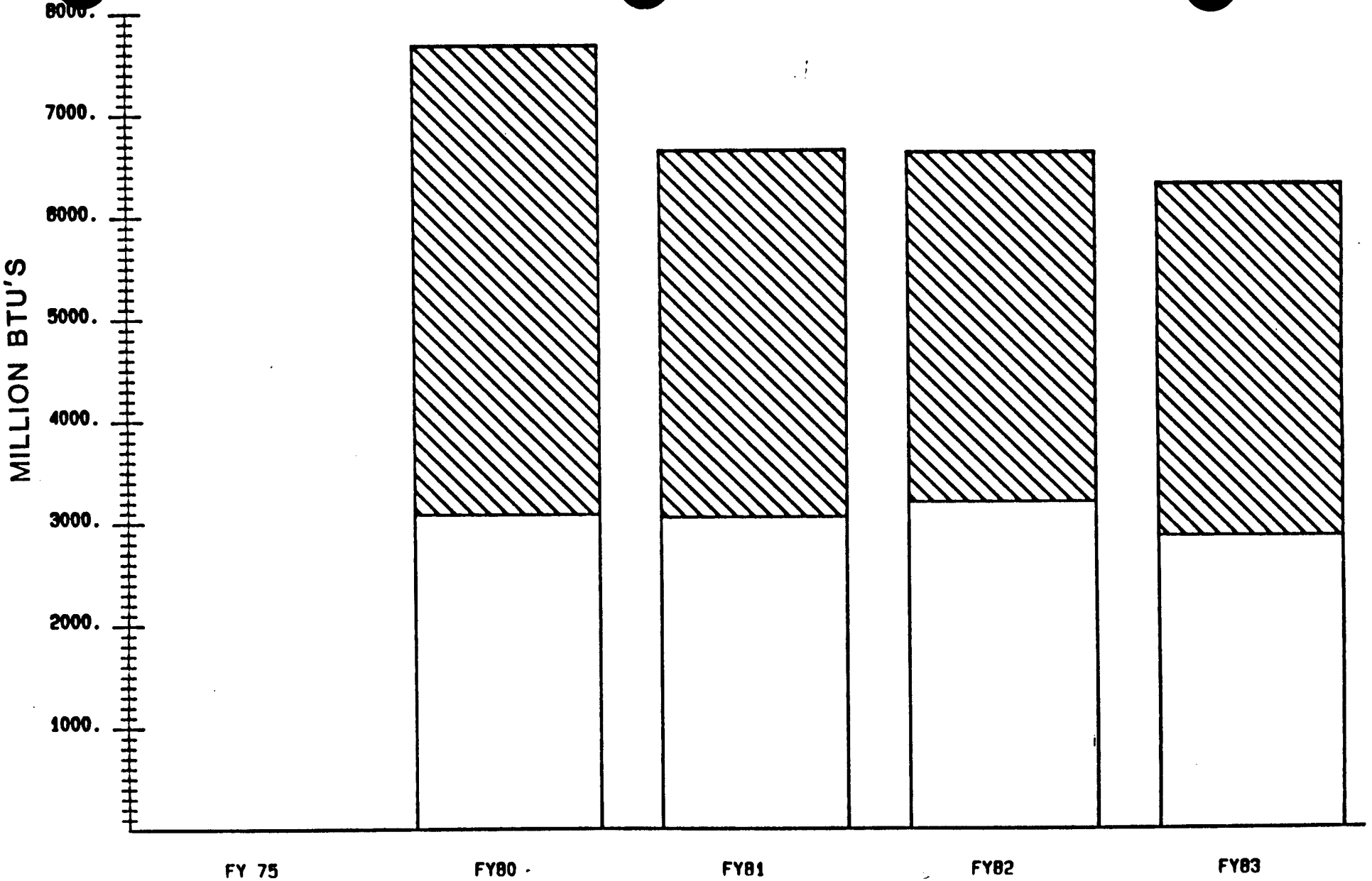
THOMAS JEFFERSON VILLAGE GY-241 TOTAL ENERGY CONSUMPTION,

FIGURE 2.5 Refer to Legend for Energy Type and BTU Equivalency



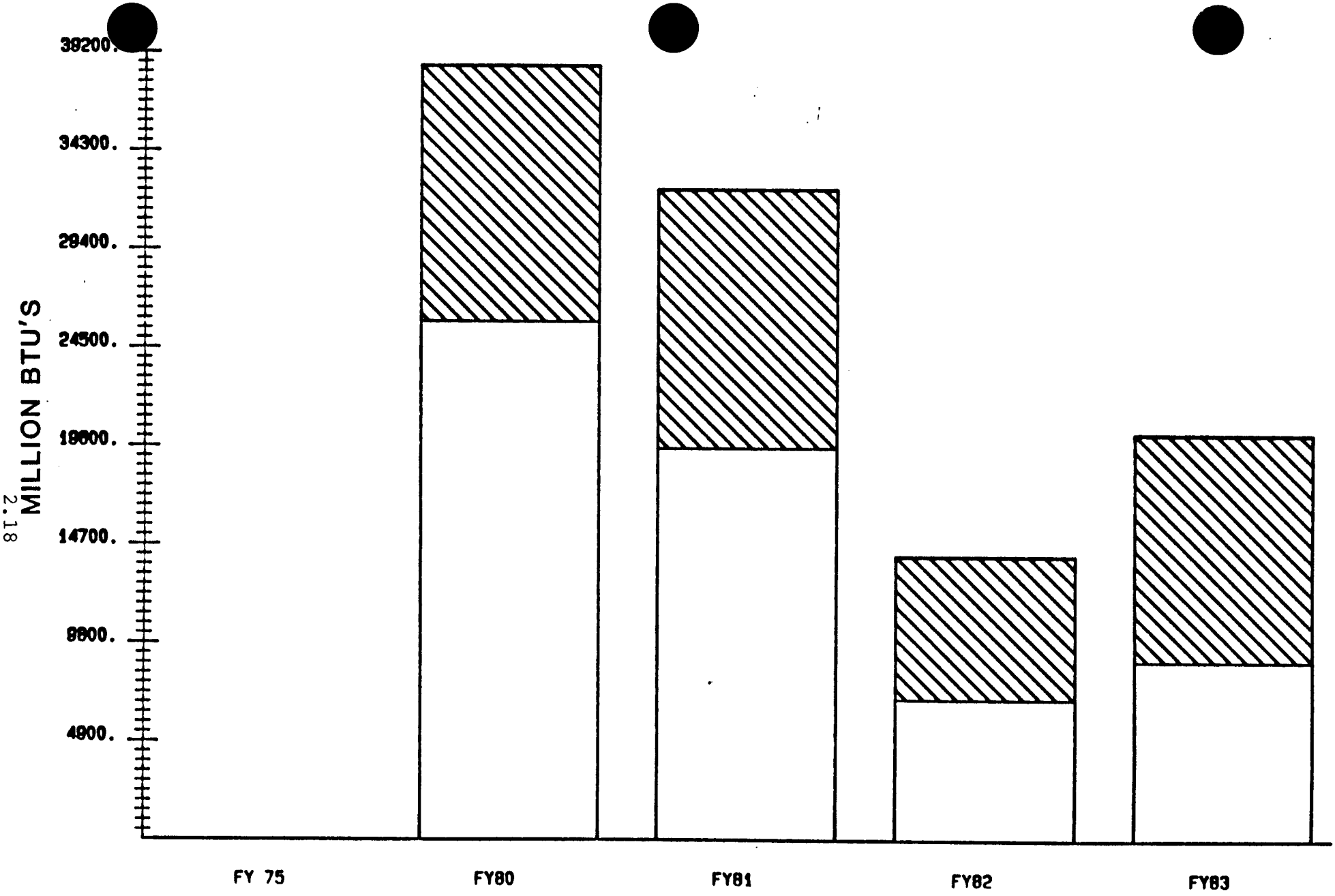
GRUENSTADT EES FACILITY GY-256 TOTAL ENERGY CONSUMPTION,

FIGURE 2.6 Refer to Legend for Energy Type and BTU Equivalency



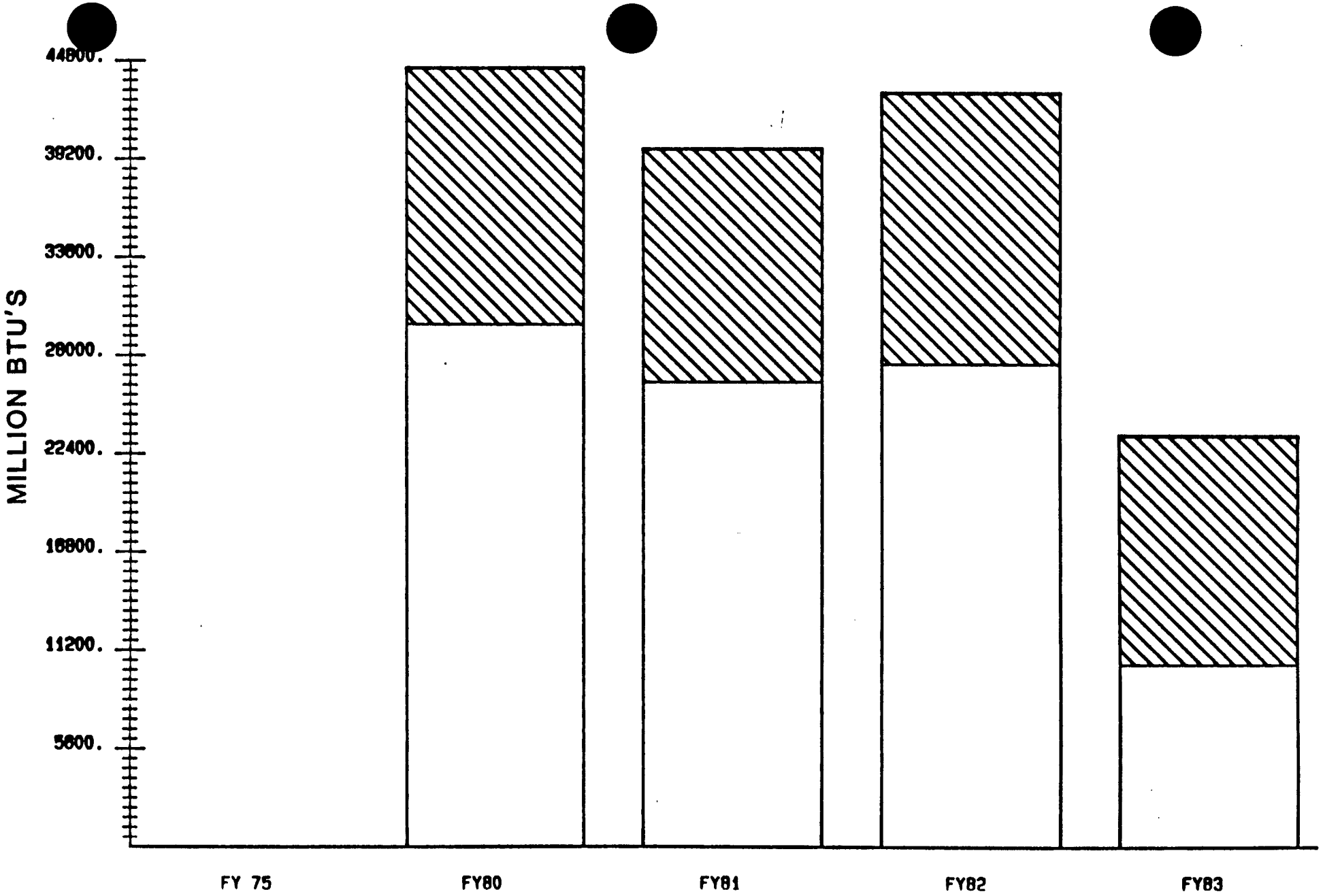
HAIDE LABOR SERVICE CAMP GY-390 TOTAL ENERGY CONSUMPTION,

FIGURE 2.7 Refer to Legend for Energy Type and BTU Equivalency



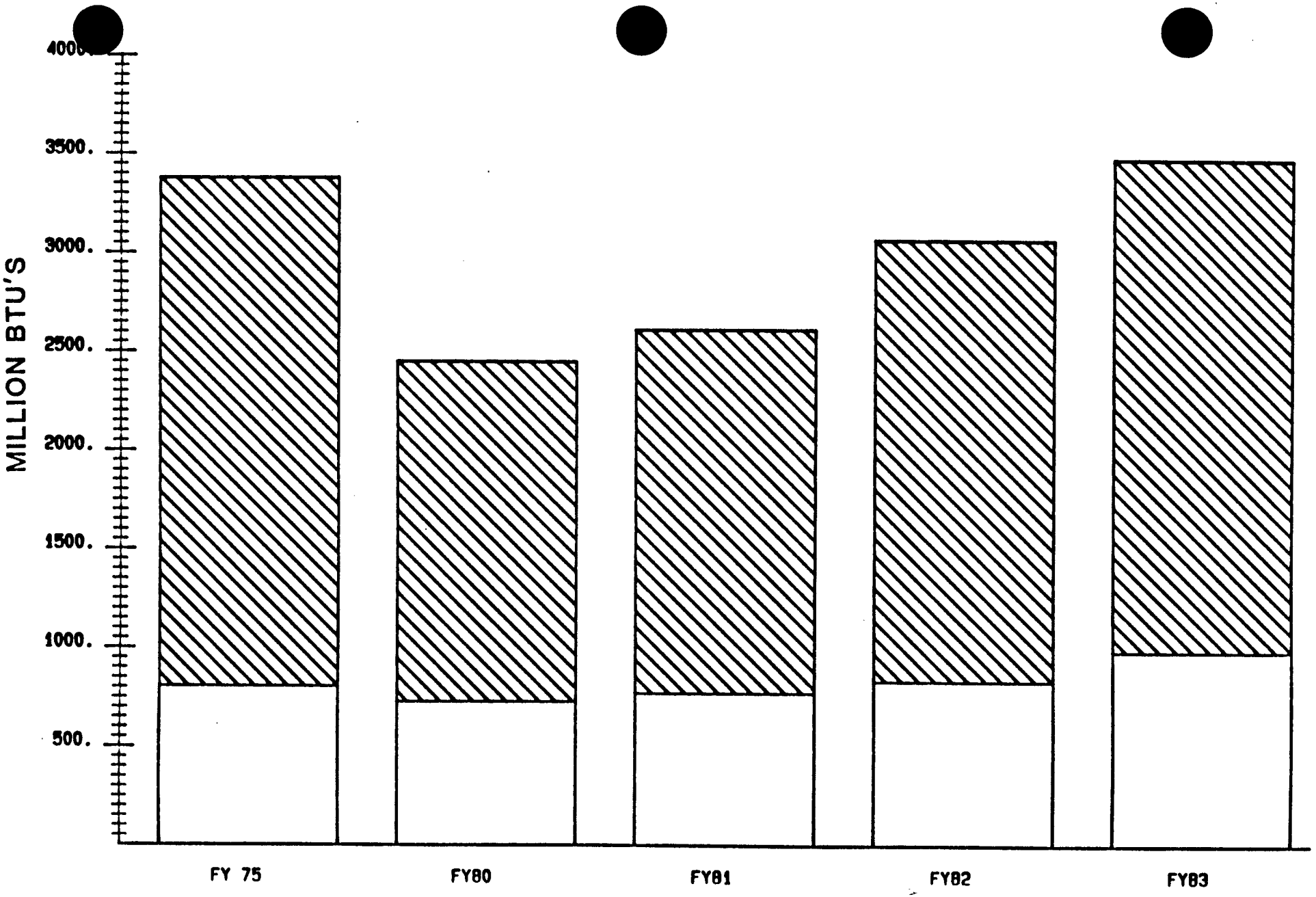
SCHOENBORN MISSLE STATION GY-434 TOTAL ENERGY CONSUMPTION,

FIGURE 2.8 Refer to Legend for Energy Type and BTU Equivalency



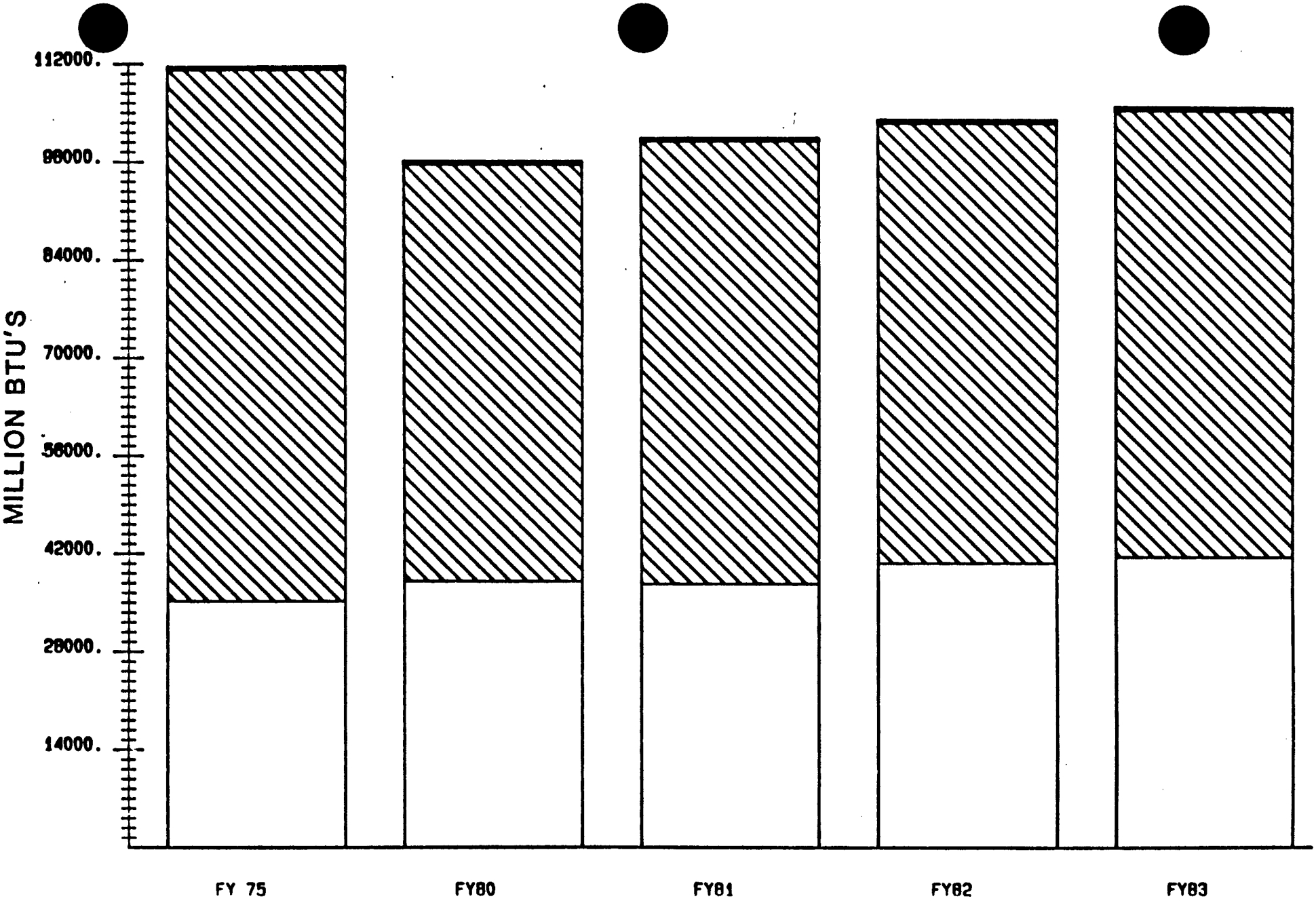
QUIRNHEIM MISSLE STATION GY-435 TOTAL ENERGY CONSUMPTION,

FIGURE 2.9 Refer to Legend for Energy Type and BTU Equivalency



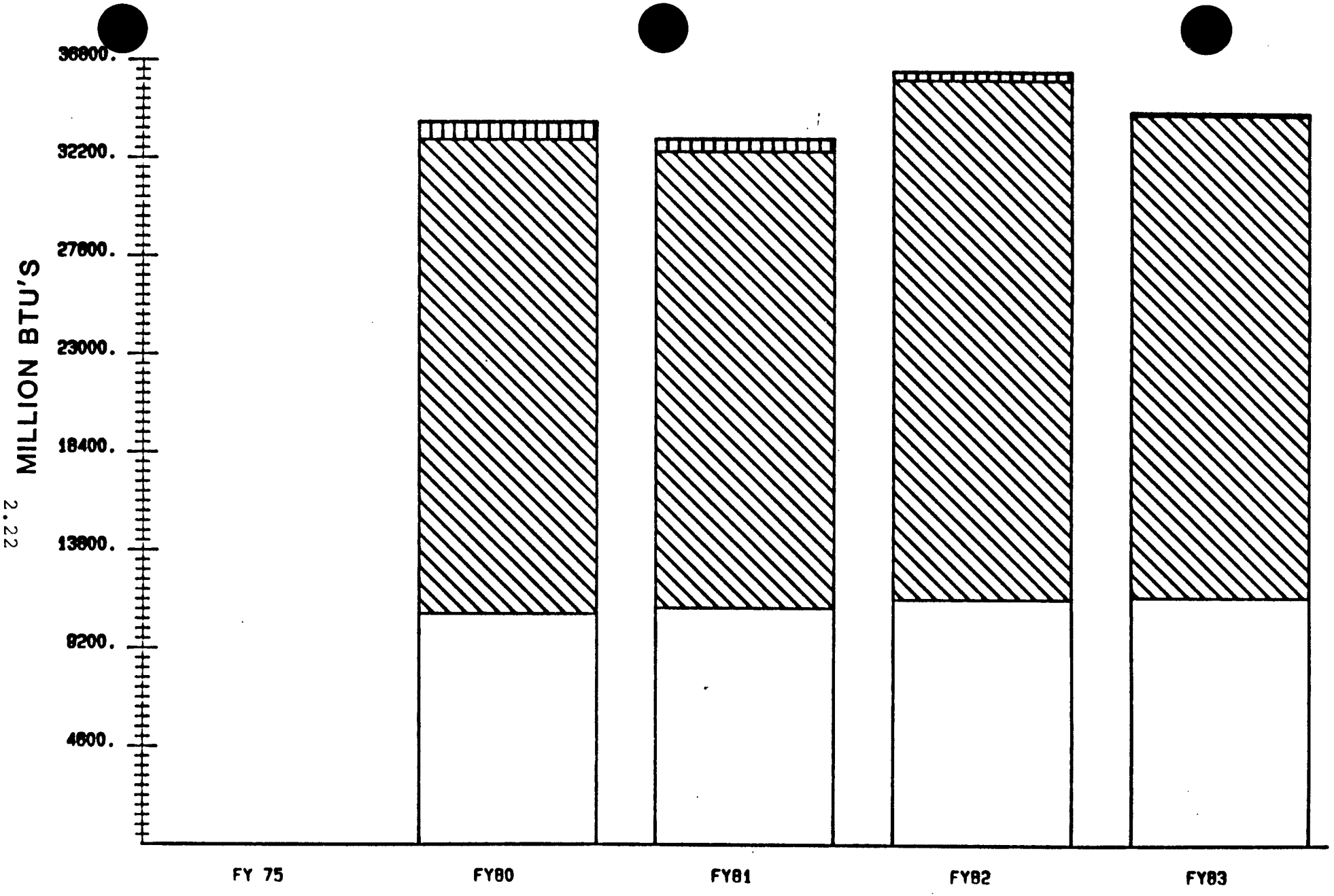
WORMS R&U AREA 'GY-512 TOTAL ENERGY CONSUMPTION,

FIGURE 2.10 Refer to Legend for Energy Type and BTU Equivalency



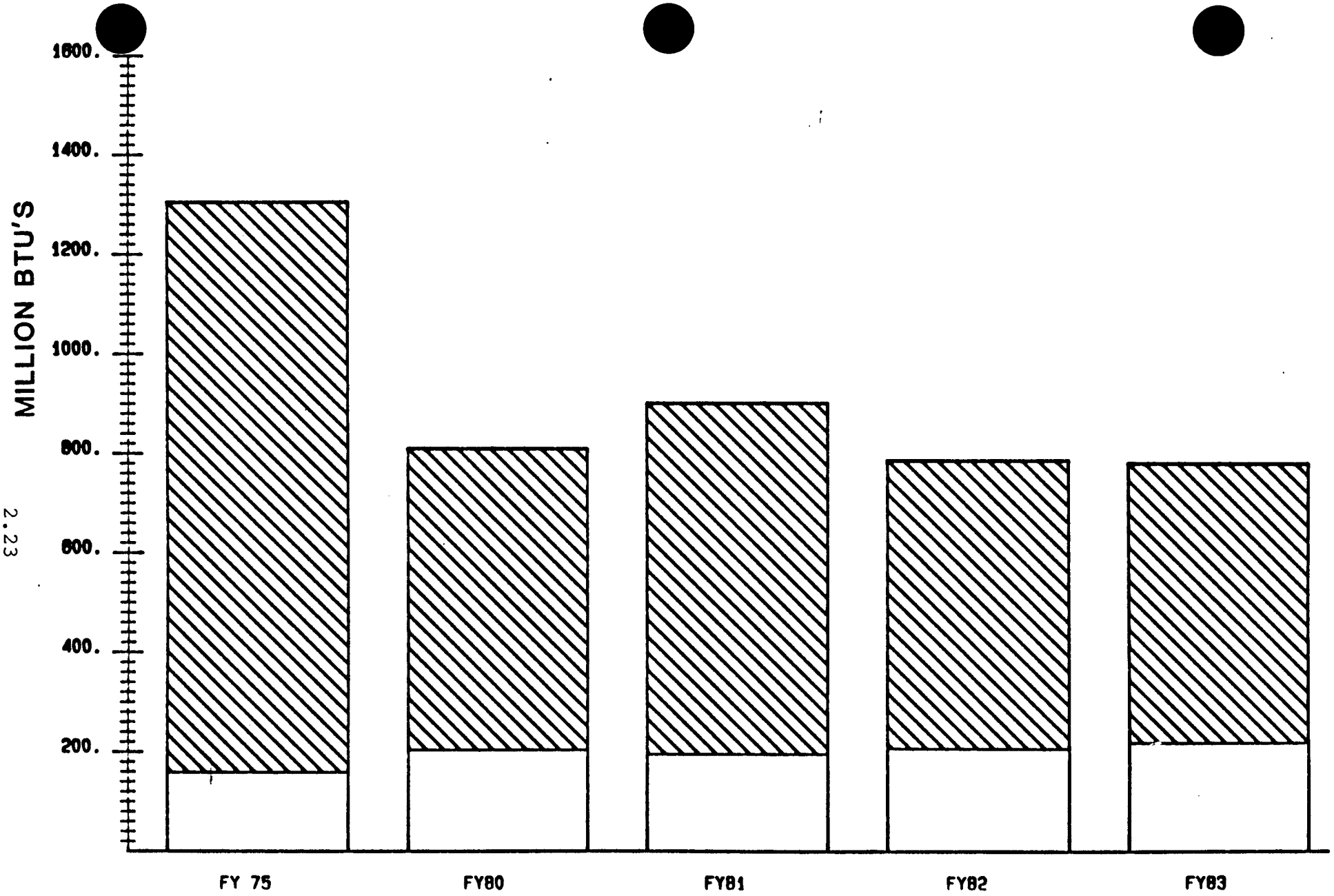
TAUKKUNEN BARRACKS GY-606 TOTAL ENERGY CONSUMPTION,

FIGURE 2.11 Refer to Legend for Energy Type and BTU Equivalency



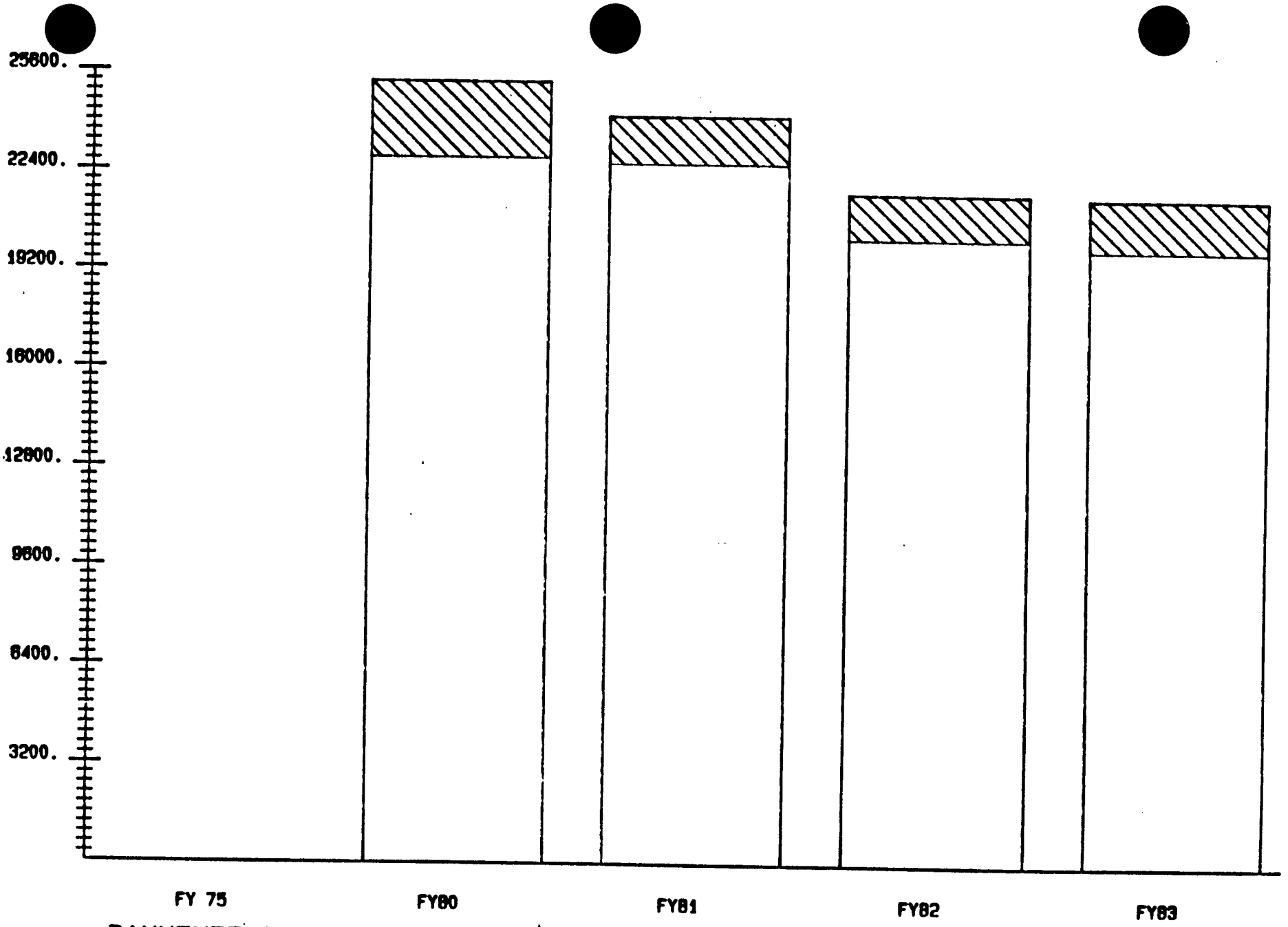
WEIERHOF FAMILY HOUSING GY-692 TOTAL ENERGY CONSUMPTION,

FIGURE 2.12 Refer to Legend for Energy Type and BTU Equivalency



WORMS QM AREA GY-775 TOTAL ENERGY CONSUMPTION,

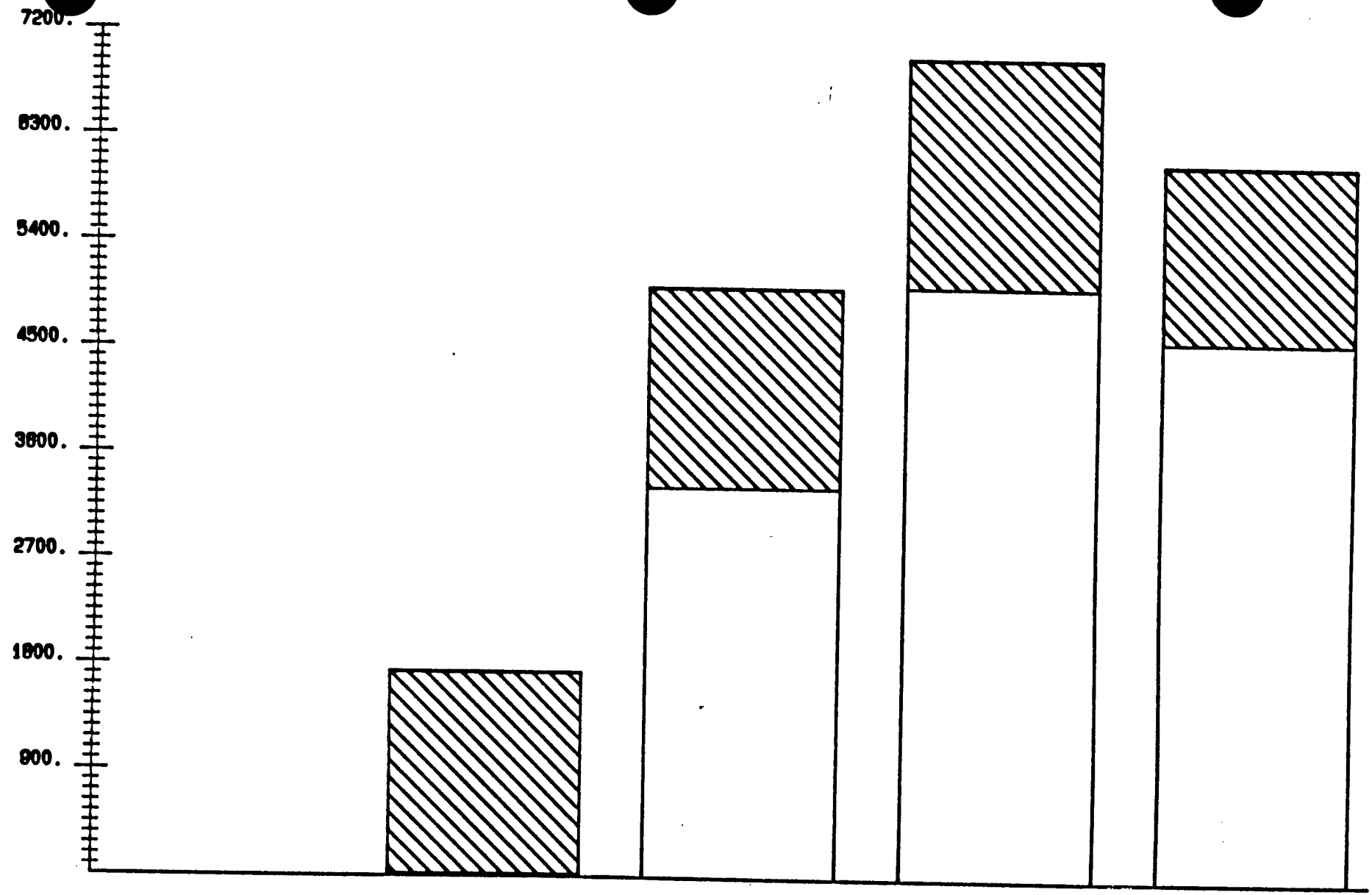
FIGURE 2.13 Refer to Legend for Energy Type and BTU Equivalency



DANNENFELS COMMUNICATIONS STATION GY-885 TOTAL ENERGY CONSUMPTION,

FIGURE 2.14

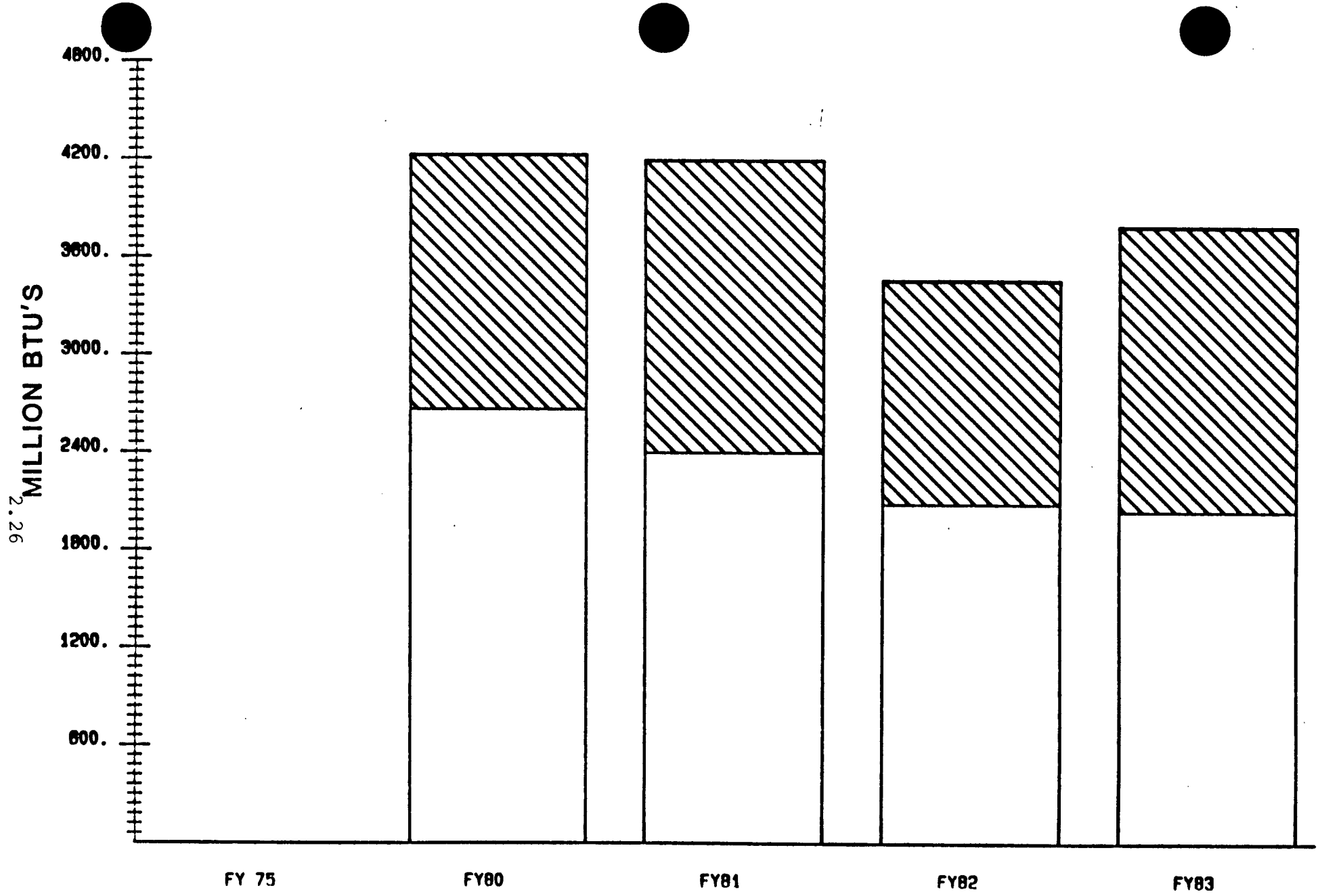
Refer to Legend for Energy Type and BTU Equivalency



HARDENBURG COMMUNICATIONS STATION GY-887 TOTAL ENERGY CONSUMPTION,

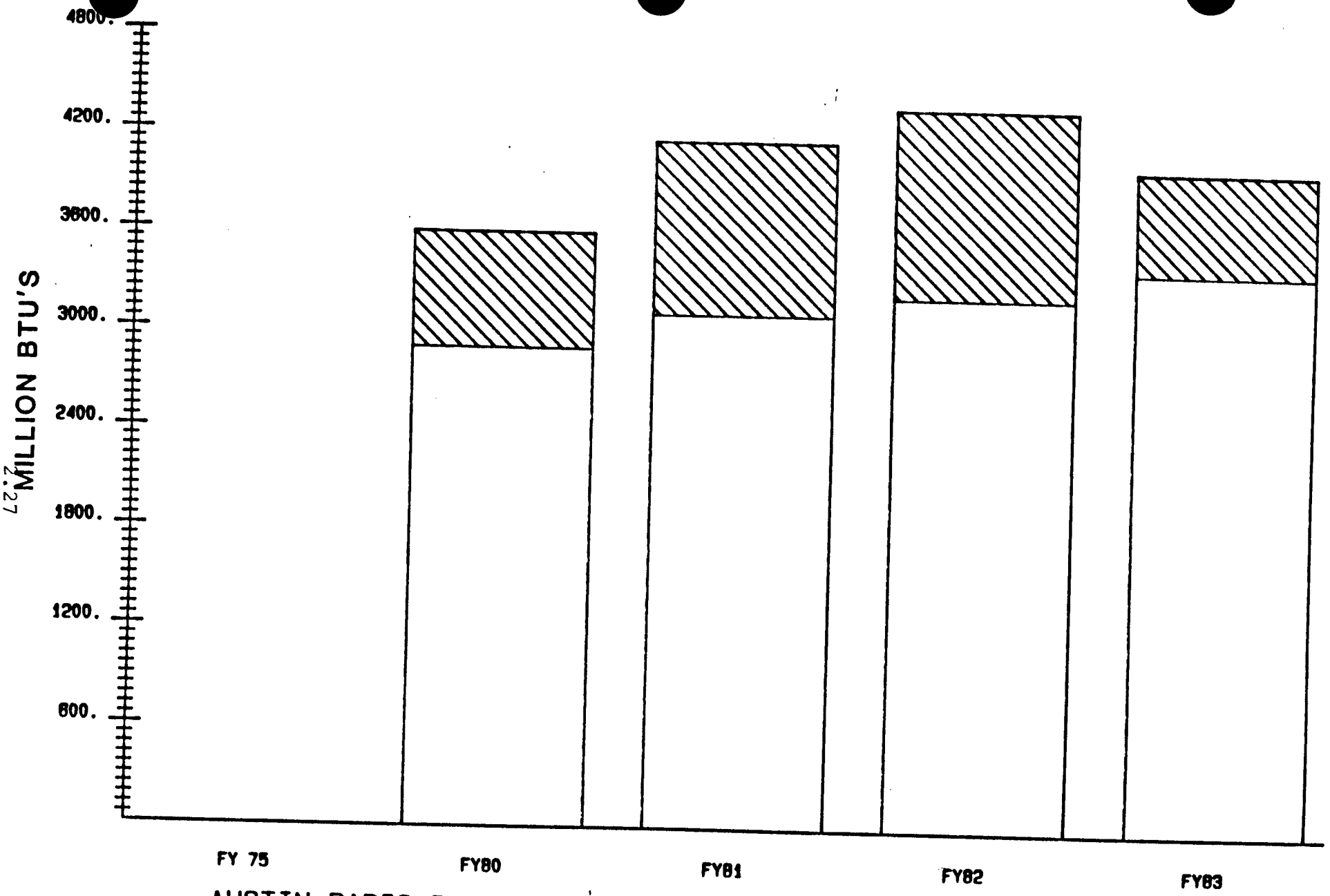
FIGURE 2.15

Refer to Legend for Energy Type and BTU Equivalency



LOHNSFELD COMMUNICATIONS STATION GY-889 TOTAL ENERGY CONSUMPTION,

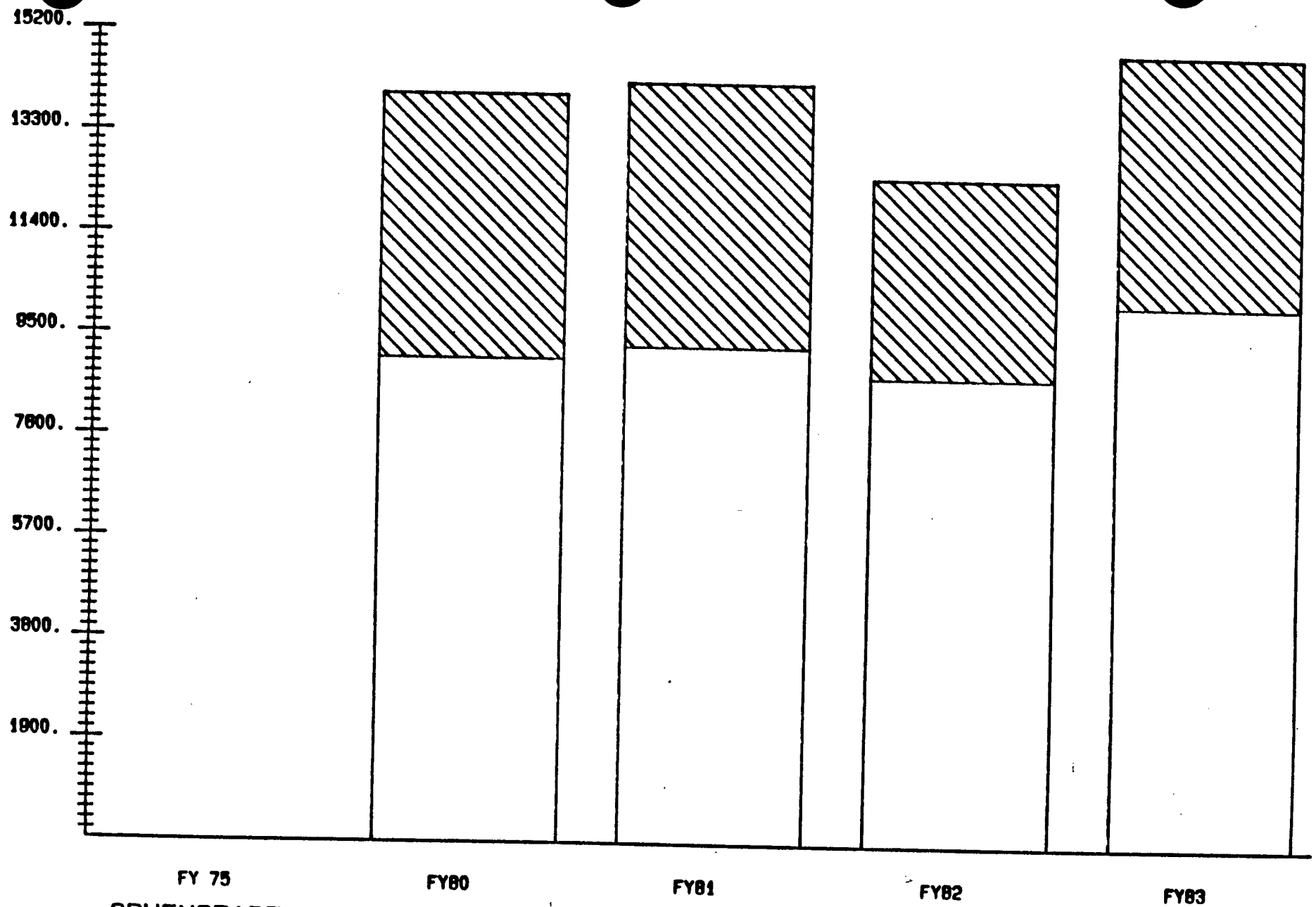
FIGURE 2.16 Refer to Legend for Energy Type and BTU Equivalency



AUSTIN RADIO RELAY STATION GY-A01 TOTAL ENERGY CONSUMPTION,

FIGURE 2.17

Refer to Legend for Energy Type and BTU Equivalency



GRUENSTADT COMMUNICATIONS STATION GY-A27 TOTAL ENERGY CONSUMPTION,

FIGURE 2.18

Refer to Legend for Energy Type and BTU Equivalency

GY AREA	FUEL	% CHANGE				
		75-80	80-81	81-82	82-83	75-83
KRIEGSFELD GY-035	ELECTRICITY	--	0.5	-7.9	14.9	--
	#2 FUEL OIL	--	5.7	-1.4	-1.5	--
	#6 FUEL OIL	--	-0.7	-8.7	-25.4	--
	TOTAL	--	2.1	-5.7	-0.8	--
DE LA POLICE GY-144	ELECTRICITY	16.5	7.1	12.2	48.6	107.9
	#2 FUEL OIL	10.2	15.3	-4.3	21.6	47.9
	TOTAL	11.7	13.2	-0.4	28.8	62.2
THOMAS JEFFERSON VILLAGE GY-241	ELECTRICITY	9.8	-0.7	1.9	3.4	14.9
	#2 FUEL OIL	-18.7	3.4	-16.4	-2.7	-31.6
	NATURAL GAS	-25.0	-13.0	-49.3	54.8	-48.8
	COAL	-17.2	-0.4	18.4	1.5	-0.9
	TOTAL	-11.2	0.3	-2.0	1.8	-11.1
GRUENSTADT EES FACILITY GY-258	ELECTRICITY	--	2.8	21.1	16.5	--
	#6 FUEL OIL	--	-20.3	34.2	18.8	--
	NATURAL GAS	--	--	--	143.8	--
	TOTAL	--	-5.9	29.3	21.3	--
HAIDE LABOR SERVICE CAMP GY-390	ELECTRICITY	--	-1.0	4.7	-10.5	--
	#2 FUEL OIL	--	-21.9	-4.6	0.8	--
	TOTAL	--	-13.5	-0.4	-4.6	--
SCHOENBORN MISSLE STATION GY-434	ELECTRICITY	--	-24.4	-64.0	27.0	--
	#2 FUEL OIL	--	1.1	-44.6	59.0	--
	TOTAL	--	-16.0	-56.3	43.1	--

FIGURE 2.19 PER CENT CHANGE OF ENERGY CONSUMPTION

GY AREA	FUEL	% CHANGE				
		75-80	80-81	81-82	82-83	75-83
QUIRNHEIM MISSLE STATION GY-435	ELECTRICITY	--	-11.0	3.8	-62.1	--
	#2 FUEL OIL	--	-9.1	16.5	-15.5	--
	TOTAL	--	-10.4	8.0	-45.4	--
WORMS R&U AREA GY-512	ELECTRICITY	-9.6	5.8	7.9	18.3	22.1
	#2 FUEL OIL	-33.1	6.9	21.3	11.7	-3.0
	TOTAL	-27.5	6.6	17.4	13.5	3.0
TAUKKUNEN BARRACKS GY-606	ELECTRICITY	8.2	-1.0	7.9	2.2	18.0
	#2 FUEL OIL	-21.6	6.2	-0.5	1.6	-15.9
	NATURAL GAS	-1.9	-3.8	-1.4	4.2	-3.0
	TOTAL	-12.2	3.4	2.6	1.8	-5.1
WEIERHOF FAMILY HOUSING GY-692	ELECTRICITY	--	2.6	3.6	1.0	--
	#2 FUEL OIL	--	-3.7	13.8	-6.9	--
	NATURAL GAS	--	-29.2	-31.8	-77.9	--
	TOTAL	--	2.3	9.5	-5.1	--
WORMS QM AREA GY-775	ELECTRICITY	28.1	-4.3	5.7	5.9	37.4
	#2 FUEL OIL	-47.1	16.5	-17.9	-3.1	-51.0
	TOTAL	-37.9	11.2	-12.8	-0.7	-40.2
DANNENFELS COMM STATION GY-885	ELECTRICITY	--	-0.8	-10.6	-1.5	--
	#2 FUEL OIL	--	-37.7	-4.9	14.4	--
	TOTAL	--	-4.4	-10.2	-0.4	--
HARDENBURG COMM STATION GY-887	ELECTRICITY	--	--	51.5	-8.8	--
	#2 FUEL OIL	--	-1.8	14.7	-23.0	--
	TOTAL	--	187.9	39.1	-12.7	--

PER CENT CHANGE OF ENERGY CONSUMPTION
FIGURE 2.19 (CONTINUED)

GY AREA	FUEL	% CHANGE				
		75-80	80-81	81-82	82-83	75-83
LOHNSFELD COMM STATION GY-889	ELECTRICITY	--	-9.9	-13.2	-2.2	--
	#2 FUEL OIL	--	14.9	-23.4	27.6	--
	TOTAL	--	-0.8	-17.5	9.6	--
AUSTIN RADIO RELAY GY-A01	ELECTRICITY	--	7.4	3.7	5.3	--
	#2 FUEL OIL	--	50.0	9.3	-46.1	--
	TOTAL	--	15.6	5.1	-8.2	--
GRUENSTADT COMM STATION GY-A27	ELECTRICITY	--	2.6	-5.8	16.0	--
	#2 FUEL OIL	--	-0.1	-24.5	26.3	--
	TOTAL	--	1.6	-12.3	19.0	--

PER CENT CHANGE OF ENERGY CONSUMPTION
FIGURE 2.19 (CONTINUED)

3.0 ENERGY CONSERVATION OPPORTUNITY (ECO) SELECTION

3.1 Introduction:

The objective of the EEAP studies is to identify military construction projects which will reduce energy consumption at Army facilities. These construction projects generally consist of several "energy conservation opportunities" logically combined in a manner to form a construction project. Energy conservation opportunities are the individual elements of work which can be performed to save energy. For example, replacing single glazed windows with double glazed windows is an energy conservation opportunity. Adding insulation to an existing roof is another example of an energy conservation opportunity. Those two ECOs might be combined for several buildings to be implemented as part of a single construction project.

3.2 ECO's Investigated:

One of the first steps in an EEAP study is to identify those energy conservation opportunities which will be analyzed as a part of the study. Once those items are identified, their applicability to a particular site or a particular building must be determined through judgement based on the field survey data included in the data report. The Army Facilities Energy Plan provides several lists of ECOs which have been successful at Army facilities.

An excerpt of this list was included in the Schedule of Title I Services for this project and includes those projects proven to be effective at Army Facilities in Europe. See Table 3.1. These ECO's were examined for their applicability to the Community's buildings and with minor exceptions and additions of the other ECO's

identified during the Field Survey, compose the master list of opportunities examined at each installation. Refer to Table 3.2.

Specific exclusions of items from the USAREUR ECO list include the following:

- Connect to district heating - Field Survey investigations revealed that no sources of district heat were available at any installation.

- Generate domestic hot water with heat pumps - The demand for domestic hot water during summer months when heat pumps are most effective is either too large in the case of family housing units or too small to make heat pump units economically attractive.

- Employ spot heaters - In most installations using unit heaters, activities are performed throughout the space, making spot heaters impractical.

- Individual metering of family housing units - As described in Section 2.4.1, because Army regulations prohibit charging occupants for utility costs, little benefit can be realized. Some family housing units in the Community presently have individual meters installed, but no programs for their use have been implemented.

In preparing the master list, ECO's were grouped according to "trade" into Architectural, Mechanical, and Electrical divisions.

Tables indicating which ECO's were to be investigated in the Phase II analysis for each building were prepared. These tables were submitted to the Community for review during Phase II, Simultaneously, a current list of planned and funded projects was obtained from the community.

Those projects which have already received funding are not to be analyzed. Unfunded projects generated by the Community including those in the design process are to be treated as non-existent and full analysis under Phase II was performed.

One ECO often studied for large military bases is installation of a Base-wide type EMCS; for the Worms Community this is not applicable. A single system could not practically control all sites since they are widely separated and function independently from a facilities operation standpoint. Cost of communications line leasing between sites would be prohibitive. An additional factor to consider is the lack of air conditioning equipment for EMCS control since very few units are present, and those that are serve critical computer/communications facilities which cannot be controlled for energy conservation. Other potential EMCS control for heating systems is largely handled functionally by existing local optimization control panels which include time clock, temperature reset, and temperature shut-off functions.

Many facilities are to small to justify an EMCS for that site alone.

TABLE 3.1 USAEUR ECO'S
(From Army Facilities Energy Plan)

1. Zone existing multiple use facilities to reduce energy consumption in minimal use areas.

2. Reschedule utilization for existing facilities.

3. Consolidate services into permanent buildings through alteration or new construction.

4. Connect to district heating in order to purchase or sell energy.

5. Inter connect existing power plants.

6. Consolidate existing power plants where forecastable non-recurring maintenance cost can be demonstrated.

7. Convert to more energy efficient fuels.

8. Improve existing power plant efficiency through the installation of flue gas dampers, turbulators in fire tube boilers and oxygen trim control.

9. Insulate existing supply and return piping.

10. Return condensate.

11. Convert existing energy distribution systems to utilize more efficient medium.

12. Recover heat from processes such as boiler blowdown, refrigerant gas, exhaust air from laundries and messhalls, destratification of air.

13. Supplement the generation of domestic hot water through installation of a heat pump.

14. Decentralize domestic hot water heaters.

15. Curtail availability of energy to domestic hot water heaters.

16. Reduce domestic hot water temperature.

17. Insulate existing domestic hot water storage tanks.

18. Install shower flow restrictors.

19. Improve street lighting efficiency be delamping (reduction of lighting level) or replacement with low or high pressure sodium.

20. Relamp with fluorescent, H.P. sodium or other more energy efficient lighting.

21. Control light levels automatically.

22. Utilize photocell switches.

23. Replace incandescent lamps with fluorescent or H.P. sodium.

24. Replace mercury vapor with high pressure sodium.

25. Utilize high efficiency ballasts.

26. Employ spot heating in lieu of existing unit heaters.

27. Individual vs. stairwell or area metering of military family housing.

28. Recommend preventive maintenance program procedures for high efficiency motor replacement.

29. Provide or improve existing controls such as thermostatic radiator valves, outside air reset, night setback, duty cycling and economizer cycles.

30. Insulate basement ceilings, walls, attic floors and roofs.

31. Install caulking and weather stripping.

32. Install storm or energy efficient windows, double glaze existing windows, reduce window area, install translucent panels, upgrade by replacement, install thermal barriers, modify sky lights.

33. Replace existing doors, install vestibules, air curtains and load dock seals.

34. Study the feasibility of peak demand shedding.

TABLE 3.2

MASTER LIST OF ECO's

ARCHITECTURAL

INSULATE ROOF OR CEILING

INSTALL DOUBLE GLAZED WINDOWS

INSTALL STORM WINDOWS OVER EXISTING WINDOWS

WEATHERSTRIP DOORS

WEATHERSTRIP WINDOWS

CAULK WINDOWS

REPLACE LOADING DOORS

INSTALL VESTIBULE

INSTALL DOOR CLOSERS

INSTALL THERMAL CURTAINS

REDUCE GLASS AREA

RESCHEDULE UTILIZATION OF EXISTING FACILITY

TABLE 3.2

MASTER LIST OF ECO's

MECHANICAL

RADIATOR VALVES

CONVERT TO HW HEAT

ADJUST CONTROLS

SPACE TEMP FEEDBACK

TIME/THERMOSTAT UNIT CONTROL

EXHAUST HOOD OUTSIDE AIR SUPPLY

REPAIR/REPLACE DAMPERS

INSULATE PIPE/EQUIPMENT

FLOW RESTRICTORS

REDUCE DHW TEMPERATURE

SUMMER WATER HEATER

DISCONTINUE DOMESTIC HOT WATER

LOCAL BOOSTER HEATER

CONVERT TO CENTRAL BOILER PLANT

REDUCE AIR STRATIFICATION

TABLE 3.2

MASTER LIST OF ECO's

MECHANICAL (con't.)

UPGRADE BOILER CONTROLS

INSTALL ECONOMIZER CONTROLS

REZONE BUILDING HEATING

INSTALL WASTE HEAT RECOVERY SYSTEMS

TABLE 3.2

MASTER LIST OF ECO's

ELECTRICAL

USE HIGHER EFFICIENCY
FLUORESCENT LAMPS

USE HIGHER EFFICIENCY
LAMPS & BALLASTS

USE HIGHER EFFICIENCY
FLUORESCENT FIXTURES

REPLACE EXISTING LENSES
WITH HIGHER EFFICIENCY TYPE

REPLACE INCANDESCENT FIXTURES
WITH FLUORESCENT

ADD SWITCHES TO TURN OFF LIGHTS
NOT IN USE

INSTALL TIMERS FOR LIGHTS IN STAIRS
AND CORRIDORS

REDUCE ILLUMINATION TO ARMY
GUIDELINE LEVELS

IMPLEMENT TASK LIGHTING METHODS

DELAMP DISPLAY FIXTURES IN
RETAIL STORES

TABLE 3.2

MASTER LIST OF ECO's

ELECTRICAL (con't.)

DISCONNECT ELECTRIC WATER COOLERS

CONSOLIDATE ELECTRIC COFFEE MAKERS

TURN OFF ELECTRICAL APPLIANCES WHEN NOT IN USE

REPLACE EXISTING LIGHTING SYSTEM WITH MORE EFFICIENT SYSTEM

ADJUST OUTDOOR LIGHTING CONTROLS

4.0 PROJECT DEVELOPMENT

4.1 Introduction:

Once the ECOs were selected for each building, the next step in the EEAP process was calculation of the savings which would result from and the cost to implement each ECO in each building. The savings from various ECOs have been calculated using a combination of manual and computerized analysis techniques.

Estimated costs have been calculated based on the extent of work in each building. Unit prices used in the estimate were obtained from Lameyer International, GMBH located in Frankfurt, West Germany. Lameyer International is a mechanical consulting and contracting firm. All construction cost estimates are in Deutsch Marks and are for FY83.

This savings and cost data for each ECO was used to compute economic parameters to determine the viability of a particular project. This economic analysis has been performed in accordance with ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) GUIDANCE dated 15 February 1985, which was furnished as criteria for the revision of this EEAP study. That ECIP guidance requires the computation of a number of economic measures. These include:

1. ECO construction cost (Deutsch Marks).

2. Total annual energy savings.

3. Annual cost savings ($).

4. Total discounted cost savings ($).

5. Discounted savings/investment ratio (SIR).

6. Discounted energy savings/investment ratio (ESIR).

Having performed the economic analysis, ECO's not meeting the minimum economic criteria of savings/investment ratio (SIR) greater than 1.0 were dropped. The remaining projects were sorted and combined to form projects falling into one of three project categories.

1. ECIP Projects.

2. Community Energy Conservation Projects.

3. Increment F Projects.

This process is described in some detail in Section 6.0 of the Energy Report.

4.2 ECIP Projects:

ECO's with SIR's and ESIR's greater than 1.0 were combined according to criteria supplied by the Community to form projects meeting the minimum project cost requirement by the ECIP criteria. For family housing, projects must cost $100,000 or more. All other ECIP projects must be of at least $200,000.

For the Worms Military Community, 8 ECIP projects were created. Two projects include insulation of family housing units. Three projects include building insulation in non-housing structures at 12 of the Community installations. Two projects include the consolidation of boiler plants. The final project is for the installation of an Energy Monitoring and Control System (EMCS) at one installation.

Summary sheets for each ECIP project containing cost, savings and economic data are presented in Tables 4.1 through 4.7. Additional prioritization of these ECIP projects and discussion of their impact on Community Energy Consumption is contained in Section 5.0 of this Report.

4.3 Community Energy Conservation Projects:

Economically viable projects whose construction costs were less than the ECIP minimum and could not be effectively combined to reach that minimum were grouped into a separate category. These projects will be funded by the community. Project documents (Form 4283) were prepared. For the Worms Community, a total of 38 separate projects were identified. Of these projects, 6 involve architectural modifications, 14 are mechanical projects, and 18 include electrical modifications. A list of these projects is contained in Table 4.8.

4.4 Increment F Projects:

Many ECO's studied were of little or no cost to implement and produced significant energy savings. These projects, such as fluorescent lamp replacement, reduction of domestic hot water temperature, and weatherstripping, are classified as Increment F projects. A separate Increment F report listing the projects identified and providing guidance on their implementation has been prepared. This report also includes recommendations on the purchase of new equipment and suggests additional training programs for Community maintenance personnel which emphasizes energy conservation techniques.

TABLE 4.1
ECIP PROJECT SUMMARY
BUILDING INSULATION - 4 BUILDINGS

GY AREA	BLDG. NO.	ECO	QUANTITY	ANNUAL ENERGY SAVINGS (MBTU/ YR)	FY89 CONSTR. COST ($)	TOTAL COST W/ ENERGY CREDIT ($)	FIRST YEAR SAVINGS ($)	TOTAL DISC. SAVINGS ($)	SIR
241	5012	2" INS. & PLAST. WALL	12216 SQ FT	511.631	43489	43641	3234	59885	1.372
241	5027	2" INS. & PLAST. WALL	12216 SQ FT	511.631	43489	43641	3234	59885	1.372
241	5030	2" INS. & PLAST. WALL	12216 SQ FT	511.631	43489	43641	3234	59885	1.372
241	5014	6" BATT INS. IN ROOF	2420 SQ FT	29.086	2008	2015	184	3404	1.689
		TOTALS		1563.979	132475	132939	9886	183059	1.377

TABLE 4.2
ECIP PROJECT SUMMARY
BUILDING INSULATION - 4 BUILDINGS

GY AREA	BLDG. NO.	ECO	QUANTITY	ANNUAL ENERGY SAVINGS (MBTU/ YR)	FY89 CONSTR. COST ($)	TOTAL COST W/ ENERGY CREDIT ($)	FIRST YEAR SAVINGS ($)	TOTAL DISC. SAVINGS ($)	SIR
692	3977	2" INS. & PLAST. WALL	15180 SQ FT	635.769	54041	54230	4018	74414	1.372
692	3989	2" INS. & PLAST. WALL	10500 SQ FT	439.131	37380	37511	2775	51399	1.370
692	3996	2" INS. & PLAST. WALL	10472 SQ FT	438.588	37280	37411	2772	51335	1.372
692	3977	6" BATT INS. IN ROOF	5811 SQ FT	396.345	4823	4840	2505	46391	9.585
692	3989	6" BATT INS. IN ROOF	5022 SQ FT	342.531	4168	4183	2165	40092	9.585
692	3996	6" BATT INS. IN ROOF	5772 SQ FT	393.685	4791	4808	2488	46079	9.585
692	3995	INS. BOARD & NEW ROOF	7300 SQ FT	473.752	23285	23367	2994	55451	2.373
		TOTALS		3119.800	165769	166349	19717	365161	2.195

TABLE [redacted]3
ECIP PROJECT SUMMARY
ROOF INSULATION - 28 BUILDINGS

ENERGY AREA	BLDG. NO.	ECO	QUANTITY	ANNUAL ENERGY SAVINGS (MBTU/ YR)	FY89 CONSTR. COST ($)	TOTAL COST /W ENERGY CREDIT ($)	FIRST YEAR SAVINGS ($)	TOTAL DISC. SAVINGS ($)	SIR
144	5900	6" WOOL INS. IN ROOF	3080 SQ FT	81.257	5205	5223	514	9511	1.821
144	5906	6" WOOL INS. IN ROOF	3480 SQ FT	58.318	5881	5902	369	6826	1.157
144	5909	6" WOOL INS. IN ROOF	2434 SQ FT	83.980	4113	4128	531	9830	2.381
144	5910	6" WOOL INS. IN ROOF	5603 SQ FT	234.990	9469	9502	1485	27505	2.895
144	5911	6" WOOL INS. IN ROOF	396 SQ FT	16.608	669	672	105	1944	2.895
144	5912	6" WOOL INS. IN ROOF	5760 SQ FT	295.200	9734	9768	1866	34552	3.537
241	5031	6" BATT INS. IN ROOF	5040 SQ FT	580.608	4183	4198	3669	67958	16.189
241	5032	6" BATT INS. IN ROOF	6144 SQ FT	56.998	5100	5117	360	6671	1.304
241	5033	6" BATT INS. IN ROOF	6752 SQ FT	62.638	5604	5624	396	7332	1.304
512	5954	6" BATT INS. IN ROOF	9664 SQ FT	405.308	8021	8049	2562	47440	5.894
606	5801	6" WOOL INS. IN ROOF	9300 SQ FT	321.129	15717	15772	2030	37587	2.383
606	5802	6" WOOL INS. IN ROOF	5320 SQ FT	183.700	8991	9022	1161	21501	2.383
606	5804	6" BATT INS. IN ROOF	8678 SQ FT	936.207	7203	7228	5917	109580	15.161
606	5808	6" WOOL INS. IN ROOF	7594 SQ FT	200.345	12834	12879	1266	23450	1.821
606	5810	6" WOOL INS. IN ROOF	2907 SQ FT	121.920	4913	4930	771	14270	2.895
606	5813	6" WOOL INS. IN ROOF	10462 SQ FT	276.008	17681	17743	1744	32306	1.821
606	5816	6" WOOL INS. IN ROOF	11137 SQ FT	293.816	18822	18887	1857	34390	1.821
606	5817	6" WOOL INS. IN ROOF	13286 SQ FT	350.511	22453	22532	2215	41026	1.821
606	5822	6" WOOL INS. IN ROOF	4263 SQ FT	112.466	7204	7230	711	13164	1.821
606	5824	6" WOOL INS. IN ROOF	7080 SQ FT	186.785	11965	12007	1180	21862	1.821
606	5828	6" WOOL INS. IN ROOF	3952 SQ FT	136.463	6679	6702	862	15972	2.383
606	5829	6" WOOL INS. IN ROOF	3510 SQ FT	92.601	5932	5953	585	10839	1.821
606	5832	6" WOOL INS. IN ROOF	10670 SQ FT	368.435	18032	18095	2329	43124	2.383
606	5834	6" WOOL INS. IN ROOF	2357 SQ FT	39.068	3983	3997	247	4573	1.144
606	5839	6" BATT INS. IN ROOF	15576 SQ FT	2273.784	12928	12973	14370	266138	20.514
775	5930	6" WOOL INS. IN ROOF	1733 SQ FT	29.044	2929	2939	183	3392	1.154
606	5838	INSTALL NEW ROOF	3500 SQ FT	345.895	11165	11204	2186	40486	3.614
606	5841	INSTALL NEW ROOF	11250 SQ FT	471.825	35888	36013	2982	55225	1.533
		TOTALS		8615.906	248226	249095	54453	1008454	4.048

TABLE 4.4
ECIP PROJECT SUMMARY
ROOF INSULATION - 29 BUILDINGS

GY AREA	BLDG. NO.	ECO	QUANTITY	ANNUAL ENERGY SAVINGS (MBTU/ YR)	FY89 CONSTR. COST ($)	TOTAL COST W/ ENERGY CREDIT ($)	FIRST YEAR SAVINGS ($)	TOTAL DISC. SAVINGS ($)	SIR
35	10007	6" BATT INS. IN ROOF	6408 SQ FT	603.755	5319	5337	2524	37780	7.079
35	10009	6" BATT INS. IN ROOF	7038 SQ FT	243.022	5842	5862	1016	15207	2.594
35	10010	6" BATT INS. IN ROOF	4452 SQ FT	419.463	3695	3708	2651	49097	13.240
35	10016	6" BATT INS. IN ROOF	7038 SQ FT	243.022	5842	5862	1016	15207	2.594
35	10150	6" BATT INS. IN ROOF	7038 SQ FT	243.022	5842	5862	1536	28445	4.852
35	10151	6" BATT INS. IN ROOF	2811 SQ FT	144.064	2333	2341	910	16862	7.202
35	10157	6" BATT INS. IN ROOF	1440 SQ FT	13.920	1195	1199	88	1629	1.358
256	3550	6" WOOL INS. IN ROOF	12168 SQ FT	510.326	20564	20636	2720	51436	2.493
434	11601	6" WOOL INS. IN ROOF	1938 SQ FT	191.527	3275	3287	1210	22418	6.821
434	11605	6" BATT INS. IN ROOF	1482 SQ FT	62.155	1230	1234	393	7275	5.894
434	11612	6" BATT INS. IN ROOF	4560 SQ FT	191.246	3785	3798	1209	22385	5.894
434	11617	6" BATT INS. IN ROOF	4560 SQ FT	191.246	3785	3798	1209	22385	5.894
434	11627	6" BATT INS. IN ROOF	4560 SQ FT	191.246	3785	3798	1209	22385	5.894
434	11655	6" BATT INS. IN ROOF	7061 SQ FT	94.263	5861	5882	596	11033	1.876
435	11536	6" WOOL INS. IN ROOF	1836 SQ FT	181.446	3103	3114	1147	21238	6.821
435	11538	6" WOOL INS. IN ROOF	1520 SQ FT	143.213	2569	2578	905	16763	6.503
435	11554	6" BATT INS. IN ROOF	4560 SQ FT	191.246	3785	3798	1209	22385	5.894
435	11560	6" BATT INS. IN ROOF	4560 SQ FT	191.246	3785	3798	1209	22385	5.894
435	11565	6" BATT INS. IN ROOF	4560 SQ FT	191.246	3785	3798	1209	22385	5.894
692	3981	6" BATT INS. IN ROOF	1768 SQ FT	127.991	1468	1473	809	14981	10.172
692	3990	6" BATT INS. IN ROOF	5915 SQ FT	54.873	4909	4927	347	6423	1.304
885	2450	6" WOOL INS. IN ROOF	2009 SQ FT	198.543	3395	3407	1255	23239	6.821
887	2480	6" BATT INS. IN ROOF	1194 SQ FT	15.945	991	995	101	1866	1.876
35	10166	INS.BOARD & NEW ROOF	3182 SQ FT	314.468	10151	10186	1987	36807	3.613
35	10167	INS.BOARD & NEW ROOF	1426 SQ FT	140.927	4549	4565	891	16495	3.613
434	11657	INS.BOARD & NEW ROOF	1964 SQ FT	185.039	6265	6287	1169	21658	3.445
885	2452	INS.BOARD & NEW ROOF	5060 SQ FT	500.065	16141	16198	3160	58531	3.613
885	2451	INS.BOARD & NEW ROOF	2068 SQ FT	204.374	6597	6620	1292	23921	3.613
256	3553	ADD INS. CEIL. PANEL	8883 SQ FT	372.553	31623	31734	1986	37550	1.183
		TOTALS		6355.456	175467	176082	36963	670171	3.806

TABLE 4.5
ECIP PROJECT SUMMARY
WALL INSULATION - 16 BUILDINGS

GY AREA	BLDG. NO.	ECO	QUANTITY	ANNUAL ENERGY SAVINGS (MBTU/ YR)	FY89 CONSTR. COST ($)	TOTAL COST W/ ENERGY CREDIT ($)	FIRST YEAR SAVINGS ($)	TOTAL DISC. SAVINGS ($)	SIR
35	10010	2" INS. & PLAST. WALL	6860 SQ FT	288.813	24422	24507	1825	33805	1.379
35	10011	2" INS. & PLAST. WALL	2700 SQ FT	113.673	9612	9646	718	13305	1.379
35	10043	2" INS. & PLAST. WALL	1392 SQ FT	197.713	4956	4973	1250	23142	4.654
35	10157	2" INS. & PLAST. WALL	3243 SQ FT	159.225	11545	11585	1006	18637	1.609
35	10169	2" INS. & PLAST. WALL	5150 SQ FT	216.820	18334	18398	1370	25378	1.379
144	5906	2" INS. & PLAST. WALL	4088 SQ FT	163.520	14553	14604	1033	19139	1.311
241	5031	2" INS. & PLAST. WALL	2759 SQ FT	165.159	9823	9857	1044	19331	1.961
241	5032	2" INS. & PLAST. WALL	9649 SQ FT	335.287	34351	34471	2119	39244	1.138
241	5033	2" INS. & PLAST. WALL	7436 SQ FT	258.386	26472	26565	1633	30243	1.138
434	11657	2" INS. & PLAST. WALL	1911 SQ FT	80.460	6804	6827	509	9418	1.379
435	11538	2" INS. & PLAST. WALL	1865 SQ FT	78.518	6639	6663	496	9190	1.379
606	5819	2" INS. & PLAST. WALL	6395 SQ FT	313.982	22766	22846	1984	36750	1.609
606	5834	2" INS. & PLAST. WALL	3840 SQ FT	153.598	13670	13718	971	17978	1.311
606	5837	2" INS. & PLAST. WALL	15388 SQ FT	755.503	54780	54972	4775	88429	1.609
692	3990	2" INS. & PLAST. WALL	2936 SQ FT	102.020	10452	10489	645	11941	1.138
775	5930	2" INS. & PLAST. WALL	1610 SQ FT	64.409	5732	5752	406	7523	1.308
		TOTALS	77222	3447.085	274911	275873	21784	403453	1.462

TABLE 4.6
ECIP PROJECT SUMMARY
BOILER CONSOLIDATION
THOMAS JEFFERSON FAMILY HOUSING

GY AREA	BLDG. NO.	ECO	ANNUAL ENERGY SAVINGS (MBTU/ YEAR)	FUEL TYPE	FY89 CONSTR. COST ($)	TOTAL COST W/ ENERGY CREDIT ($)	FIRST YEAR SAVINGS ($)	TOTAL DISCOUNT. SAVINGS ($)	SIR	ESIR
241	AREA	CENTRAL BOILER PLANT	34245.0 38610.0 -58922.0	#2 OIL A. COAL B. COAL	2020747	2027820	329476	4994087	2.463	2.003
		TOTALS	13933.0		2020747	2027820	329476	4994087	2.463	2.003

TABLE 4.7
ECIP PROJECT SUMMARY
BOILER CONSOLIDATION
WEIERHOF FAMILY HOUSING

GY AREA	BLDG. NO.	ECO	ANNUAL ENERGY SAVINGS (MBTU / YEAR)	FUEL TYPE	FY89 CONSTR. COST ($)	TOTAL COST W/ ENERGY CREDIT ($)	FIRST YEAR SAVINGS ($)	TOTAL DISCOUNT. SAVINGS ($)	SIR	ESIR
692	HOUSING	CENTRAL BOILER PLANT	21884.0 -19148.0	#2 OIL B. COAL	729750	732304	96501	2066898	2.822	2.822
		TOTALS	2736.0		729750	732304	96501	2066898	2.822	2.822

TABLE 4.8

COMMUNITY ENERGY CONSERVATION PROJECTS

ARCHITECTURAL

GY AREA	TYPE OF WORK	PROJECT COST	ENERGY SAVINGS
GY 035	Replace Windows	$ 5,266	48.6 MBTU/Yr
GY 144	Replace Windows	$16,374	109.3 MBTU/Yr
GY 241	Reduce Glass Area	$ 9,908	95.1 MBTU/Yr
GY 256	Replace Windows	$33,094	500.8 MBTU/Yr
GY 434	Replace Doors	$10,696	109.4 MBTU/Yr
GY 606	Replace Windows	$17,690	199.5 MBTU/Yr
		$93,028	1,062.7 MBTU/Yr

TABLE 4.8

COMMUNITY ENERGY CONSERVATION PROJECTS

MECHANICAL

GY AREA	TYPE OF WORK	PROJECT COST	ENERGY SAVINGS
GY 035	Control Mods.	$ 7,968	381.8 MBTU.Yr
GY 035	Boiler Plant Mods.	$ 34,273	745.4 MBTU/Yr
GY 035	Exhaust Hood O.A.	$ 2,104	19.1 MBTU/Yr
GY 241	Control Mods.	$ 34,688	2484.8 MBTU/Yr
GY 241	Waste Heat Recov.	$ 6,017	62.0 MBTU/Yr
GY 241	Exhaust Hood O.A.	$ 12,062	110.3 MBTU/Yr
GY 256	Waste Heat Recov.	$ 97,341	5,950 MBTU/Yr
GY 256	HVAC Controls	$ 41,184	20,409 MBTU/Yr
GY 606	Boiler Controls	$ 17,698	638.6 MBTU/Yr
GY 606	Exhaust Hood O.A.	$ 6,732	61.3 MBTU/Yr
GY 606	Control Mods.	$ 24,584	113.4 MBTU/Yr
GY 692	Control Mods.	$ 2,400	121.6 MBTU/Yr
GY 775	Control Mods.	$ 2,075	73.4 MBTU/Yr

TABLE 4.8

COMMUNITY ENERGY CONSERVATION PROJECTS

MECHANICAL (con't.)

GY AREA	TYPE OF WORK	PROJECT COST	ENERGY SAVINGS
GY 885	Control Mods.		
GY A01	Control Mods.		
GY A27	Control Mods.	$ 712	26.1 MBTU/Yr
		$289,838	32,196.8 MBTU/Yr

TABLE 4.8

COMMUNITY ENERGY CONSERVATION PROJECTS

ELECTRICAL

GY AREA	TYPE OF WORK	PROJECT COST	ENERGY SAVINGS
GY 035	Lighting Mods.	$ 12,107	526.2 MBTU/Yr
GY 144	Electrical Renov.	$ 4,661	132.0 MBTU/Yr
GY 241	Electrical Renov.	$ 7,530	245.7 MBTU/Yr
GY 241	Replace Outdoor Ltg.	$ 5,531	184.0 MBTU/Yr
GY 256	Electrical Renov.	$ 46,557	1563.0 MBTU/Yr
GY 390	Replace Outdoor Ltg.	$ 619	23.7 MBTU/Yr
GY 434	Replace Outdoor Ltg.	$ 2,788	123.8 MBTU/Yr
GY 434	Electrical Renov.	$ 15,487	338.4 MBTU/Yr
GY 435	Electrical Renov.	$ 15,950	355.6 MBTU/Yr
GY 435	Replace Outdoor Ltg.	$ 2,788	123.8 MBTU/Yr
GY 512	Electrical Renov.	$ 1,020	24.5 MBTU/Yr
GY 606	Electrical Renov.	$ 18,732	667.6 MBTU/Yr
GY 606	Replace Outdoor Ltg.	$ 6,194	206.0 MBTU/Yr
GY 692	Electrical Renov.	$ 1,149	21.8 MBTU/Yr

TABLE 4.8

COMMUNITY ENERGY CONSERVATION PROJECTS

ELECTRICAL (con't.)

GY AREA	TYPE OF WORK	PROJECT COST	ENERGY SAVINGS
GY 885	Electrical Renov.	$ 10,641	172.6 MBTU/Yr
GY 887	Electrical Renov.	$ 865	20.2 MBTU/Yr
GY 889	Electrical Renov.	$ 46	.965 MBTU/Yr
GY A01	Electrical Renov.	$ 372	7.72 MBTU/Yr
		$153,037	4,737.6 MBTU/Yr

5.0 PROJECT IMPACT

5.1 Introduction:

The ultimate goal of the EEAP process is to conserve energy and save money. It is easy to loose sight of this goal however and get lost in the reams of paper, and millions of calculations that compose the supporting documentation of the EEAP study. In the following sections, energy savings associated with each project developed for each energy source used are compared with present energy consumption and energy consumption of the reference year FY 75.

5.2 Projected Energy Savings:

Tables 5.1 through 5.16 summarize energy savings for each type of energy conservation project for each installation. Energy savings are listed in MBTU's using energy equivalency conversion factors supplied in the ECIP criteria. In the interest of being concise, the total energy savings by fuel type for all Increment F projects is listed rather than listing each Increment F project separately. For more detailed discussion of energy savings for each project, refer to the Increment F report.

Results of these energy conservation projects impact on annual energy consumption is presented graphically in Figures 5.17 through 5.32. These figures show total energy consumption for FY 75, FY 83 and projected energy usage after energy conservation project implementation for each installation.

Table 5.33 lists the total energy consumption in MBTU/year by installation for FY 75, FY 83, and the projected consumption after the implementation of all ECO's.

Percent change in energy consumption is also tabulated. Because complete utility data for each installation for FY 75 was not available, it is not possible to comment on energy savings for the entire Community with respect to the base line year. However, as compared with FY 83, the implementation of all ECO's will save 103,363 MBTU/year which is equivalent to a 14.94% reduction in energy consumption.

5.3 ECIP Project Ranking:

The eight ECIP projects identified through the EEAP process are listed in Table 5.34 in order of SIR. Additional summary data on project cost and savings is included to aid in project programming.

TABLE 5.1 GY 035

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	484.9
	Bit. Coal	279.9
Mechanical	No. 2 Oil	1020.96
	Bit. Coal	1292.86
Electrical	Elect.	189.0
COMMUNITY CONSERVATION		
Replace Windows	No. 2 Oil	48.6
Control Modifications	No. 2 Oil	270.4
	Bit. Coal	111.4
Boiler Controls	No. 2 Oil	120.8
	Bit. Coal	624.6
Exhaust Hood O.A.	No. 2 Oil	19.1
Lighting Modifications	Elect.	526.2

TABLE 5.1 GY 035 (con't.)
ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
ECIP		
Wall Insulation	No. 2 Oil	976.2
Roof Insulation	No. 2 Oil	401.0
	Bit. Coal	486.0
TOTAL		
	No. 2 Oil	3342.
	Bit. Coal	2795.
	Elect.	715.
	TOTAL	6,852

TABLE 5.2 GY 144

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	38.54
Mechanical	No. 2 Oil	100.4
Electrical	Elect.	778.1
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	132.0
Replace Windows	No. 2 Oil	109.3
ECIP		
Wall Insulation	No. 2 Oil	163.5
Roof Insulation	No. 2 Oil	770.4
TOTALS		
	No. 2 Oil	1182.
	Elect.	910.
	Total	2092.

TABLE 5.3 GY 241

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	Anth. Coal	245.8
	No. 2 Oil	320.8
Mechanical	Anth. Coal	3076.8
	No. 2 Oil	1904.4
Electrical	Elect.	42.3
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	245.7
Outdoor Lighting	Elect.	184.0
Waste Heat Recov.	No. 2 Oil	62.0
Exhaust Hood O.A.	No. 2 Oil	110.3
Controls Mod.	No. 2 Oil	650.5
	Anth. Coal	1834.3
Reduce Windows	No. 2 Oil	95.1

TABLE 5.3 GY 241 (con't.)
ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
ECIP		
Wall & Roof Insul.	No. 2 Oil	1563.9
Roof Insul.	No. 2 Oil	700.2
Wall Insul.	No. 2 Oil	758.8
Central Plant	No. 2 Oil	34,245
	Anth. Coal	38,610
	Bit. Coal	-58,922
TOTALS		
	No. 2 Oil	40,411
	Anth Coal	43,767
	Elect.	472
	Bit. Coal	-58,922
	Total	24,728

TABLE 5.4 GY 256

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 6 Oil	145.0
Mechanical	No. 6 Oil	553.1
Electrical	Elect.	116.9
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	1563.0
Waste Heat Recov.	No. 6 Oil	5950.0
Control Mods.	No. 6 Oil	21,382.4
	Elect.	20.5
Replace Windows	No. 6 Oil	500.8
ECIP		
Roof Insul.	No. 6 Oil	882.9
EMCS	No. 6 Oil	3,900.0
TOTALS		
	No. 6 Oil	33,314
	Elect.	5,850
	Total	39,164

TABLE 5.5 GY 390

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	73.7
Mechanical	No. 2 Oil	314.5
Electrical	Elect.	81.5
COMMUNITY CONSERVATION		
Outside Lighting	Elect.	23.7
TOTALS		
	No. 2 Oil	388.
	Elect.	105.
	Totals	493.

TABLE 5.6 GY 434

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	185.8
Mechanical	No. 2 Oil	799.4
Electrical	Elect.	134.1
COMMUNITY CONSERVATION		
Outside Lighting	Elect.	123.8
Electrical Renov.	Elect.	338.4
Replace Doors	No. 2 Oil	109.4
ECIP		
Wall Insul.	No. 2 Oil	80.5
Roof Insul.	No. 2 Oil	285.8
TOTALS		
	Elect.	596
	No. 2 Oil	1,461
	Total	2,057

TABLE 5.7 GY 435

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	Elect.	4.9
	No. 2 Oil	229.4
Mechanical	No. 2 Oil	737.1
Electrical	Elect.	168.7
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	355.6
Outside Lighting	Elect.	123.8
ECIP		
Wall Insul.	No. 2 Oil	78.5
Roof Insul.	No. 2 Oil	573.7
TOTALS		
	Elect.	1,619
	No. 2 Oil	653
	Total	1,272

TABLE 5.8 GY 512

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	126.7
Mechanical	No. 2 Oil	132.1
Electrical	Elect.	5.0
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	24.5
ECIP		
Roof Insul.	No. 2 Oil	405.3
TOTALS		
	Elect.	664.
	No. 2 Oil	30.
	Total	694.

TABLE 5.9 GY 606

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	500.2
Mechanical	No. 2 Oil	3299.0
Electrical	Elect.	1752.3
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	667.6
Replace Lighting	Elect.	206.0
Boiler Controls	No. 2 Oil	638.6
Exhaust Hood O.A.	No. 2 Oil	61.3
Controls Mods.	No. 2 Oil	1113.4
Replace Windows	No. 2 Oil	199.5
ECIP		
Wall Insul.	No. 2 Oil	1223.1
Roof Insul.	No. 2 Oil	6711.0
TOTALS		
	No. 2 Oil	13,746
	Elect.	2,626
	TOTAL	16,372

TABLE 5.10 GY 692

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	50.4
Mechanical	No. 2 Oil	1514.2
	Nat. Gas	7.0
	Elect.	10.9
Electrical	Elect.	13.1
COMMUNITY CONSERVATION		
Controls Mods.	No. 2 Oil	121.6
Electrical Renova.	Elect.	21.8
ECIP		
Wall and Roof Insul.	No. 2 Oil	3119.8
Wall Insul.	No. 2 Oil	102.0
Roof Insul.	No. 2 Oil	182.9
Boiler Consolidation	No. 2 Oil	21,884
	Bit. Coal	-19,148

TABLE 5.10 GY 692 (con't.)
ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
TOTALS		
	No. 2 Oil	26,975
	Elect.	46
	Nat. Gas	7.0
	Bit. Coal	-19,148
	Total	7,880

TABLE 5.11 GY 775

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	14.43
Mechanical	--	--
Electrical	--	--
COMMUNITY CONSERVATION		
Control Mods.	No. 2 Oil	73.4
ECIP		
Wall Insul.	No. 2 Oil	64.4
Roof Insul.	No. 2 Oil	29.0
TOTAL		
	No. 2 Oil	181.

TABLE 5.12 GY 885
ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	--	--
Mechanical	No. 2 Oil	2.9
Electrical	Elect.	62.9
COMMUNITY CONSERVATION		
Controls Mods.	No. 2 Oil	7.3
Electrical Renov.	Elect.	172.6
TOTAL		
	No. 2 Oil	10.
	Elect.	236
	Total	246

TABLE 5.13 GY 887

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	.56
Mechanical	No. 2 Oil	325.4
Electrical	--	--
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	20.2
ECIP		
Roof Insul.	No. 2 Oil	15.9
TOTAL		
	No. 2 Oil	342
	Elect.	20.
	Total	362

TABLE 5.14 GY 889

ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	24.4
Mechanical	No. 2 Oil	115.2
Electrical	--	--
COMMUNITY CONSERVATION		
Electrical Renov.	Elect.	0.96
TOTAL		
	No. 2 Oil	139.6
	Elect.	.96
	Total	141

TABLE 5.15 GY A01

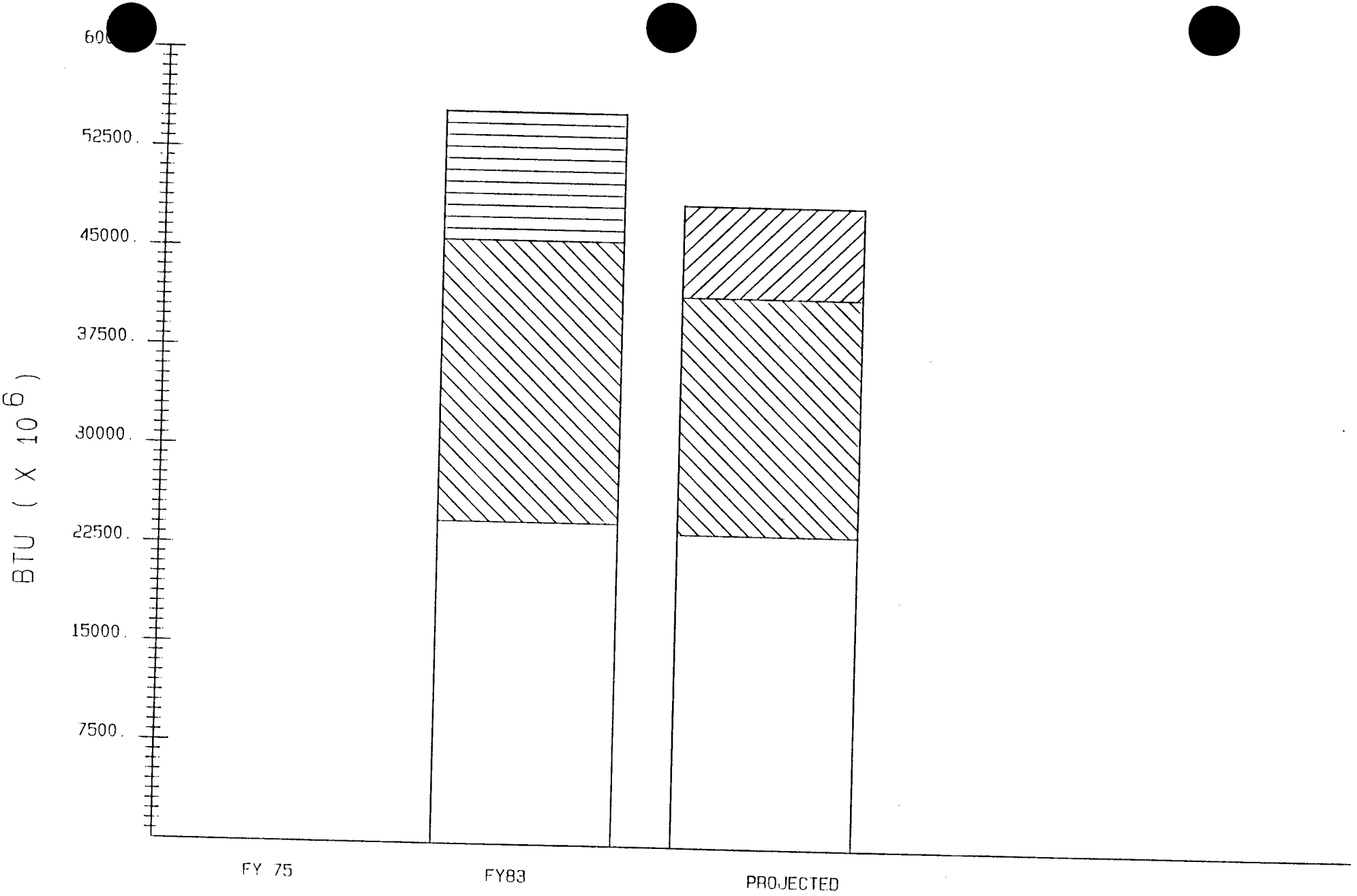
ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	.74
Mechanical	No. 2 Oil	375.4
Electrical	--	--
COMMUNITY CONSERVATION		
Control Mods.	No. 2 Oil	16.4
Electrical Renov.	Elect.	7.7
TOTAL		
	No. 2 Oil	393
	Elect.	8
	Total	401

TABLE 5.16 GY A27

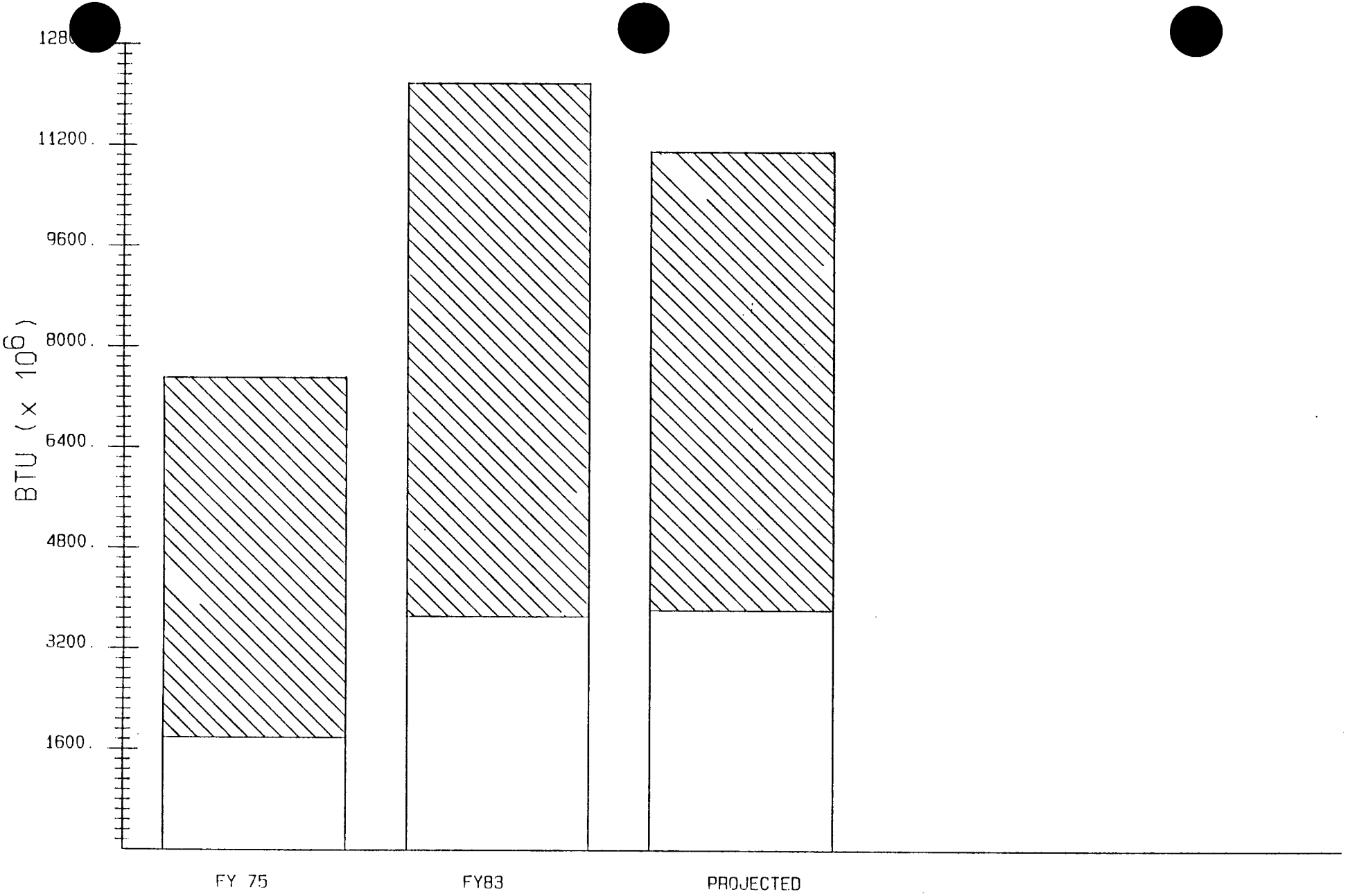
ENERGY CONSERVATION SUMMARY

INCREMENT F	ENERGY TYPE	SAVINGS (MBTU/YR)
Architectural	No. 2 Oil	220.5
Mechanical	No. 2 Oil	217.6
Electrical	--	--
COMMUNITY CONSERVATION		
Control Mods.	No. 2 Oil	2.4
TOTAL		
	No. 2 Oil	440.



KRIEGSFELD AMMO DEPOT GY-035 TOTAL ENERGY CONSUMPTION,
FIGURE 5.17,

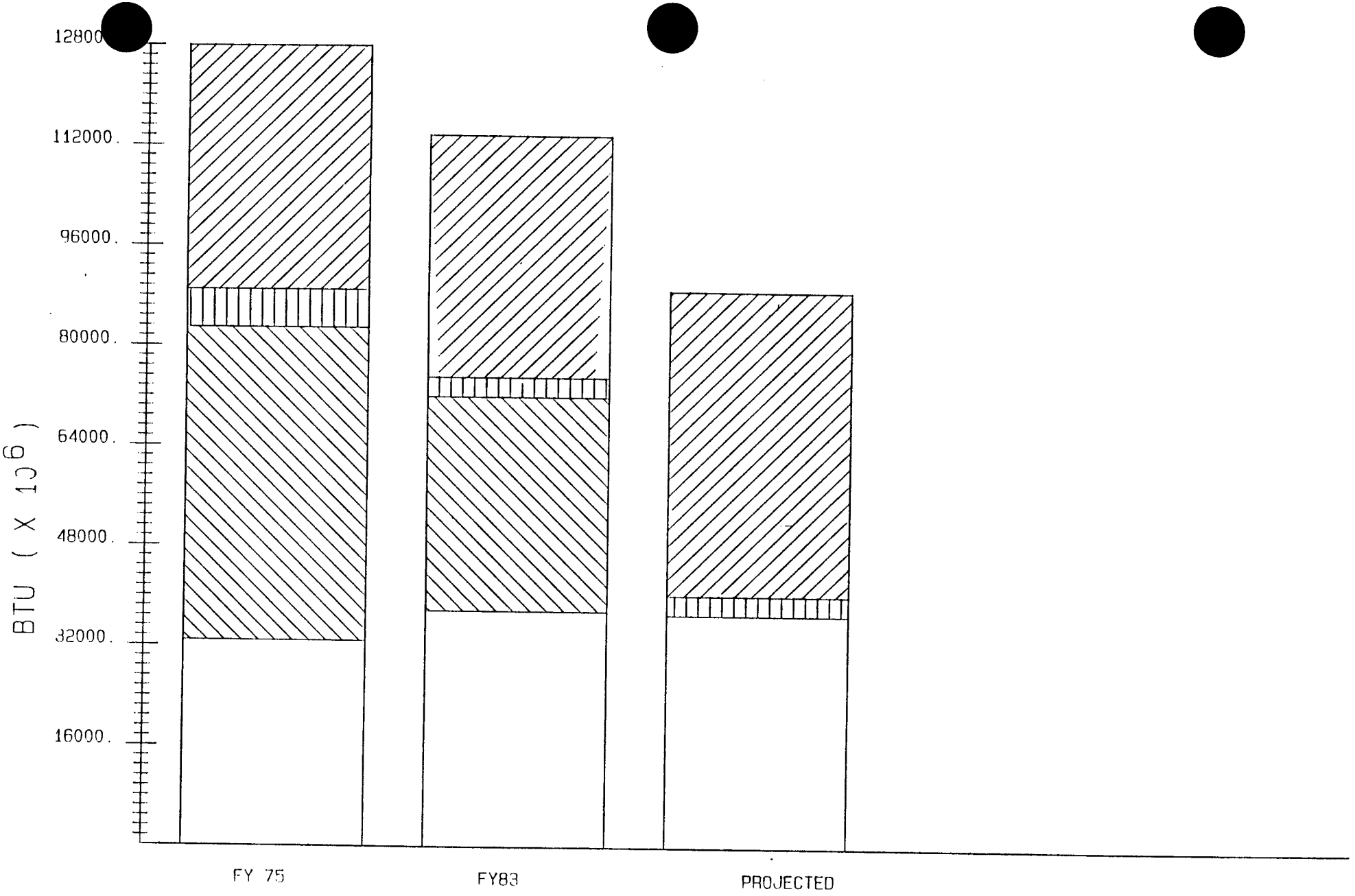
Refer to Legend for Energy Type and BTU Equivalency



DE LA POLICE KASERNE GY-144. TOTAL ENERGY CONSUMPTION,

Refer to Legend for Energy Type and BTU Equivalency

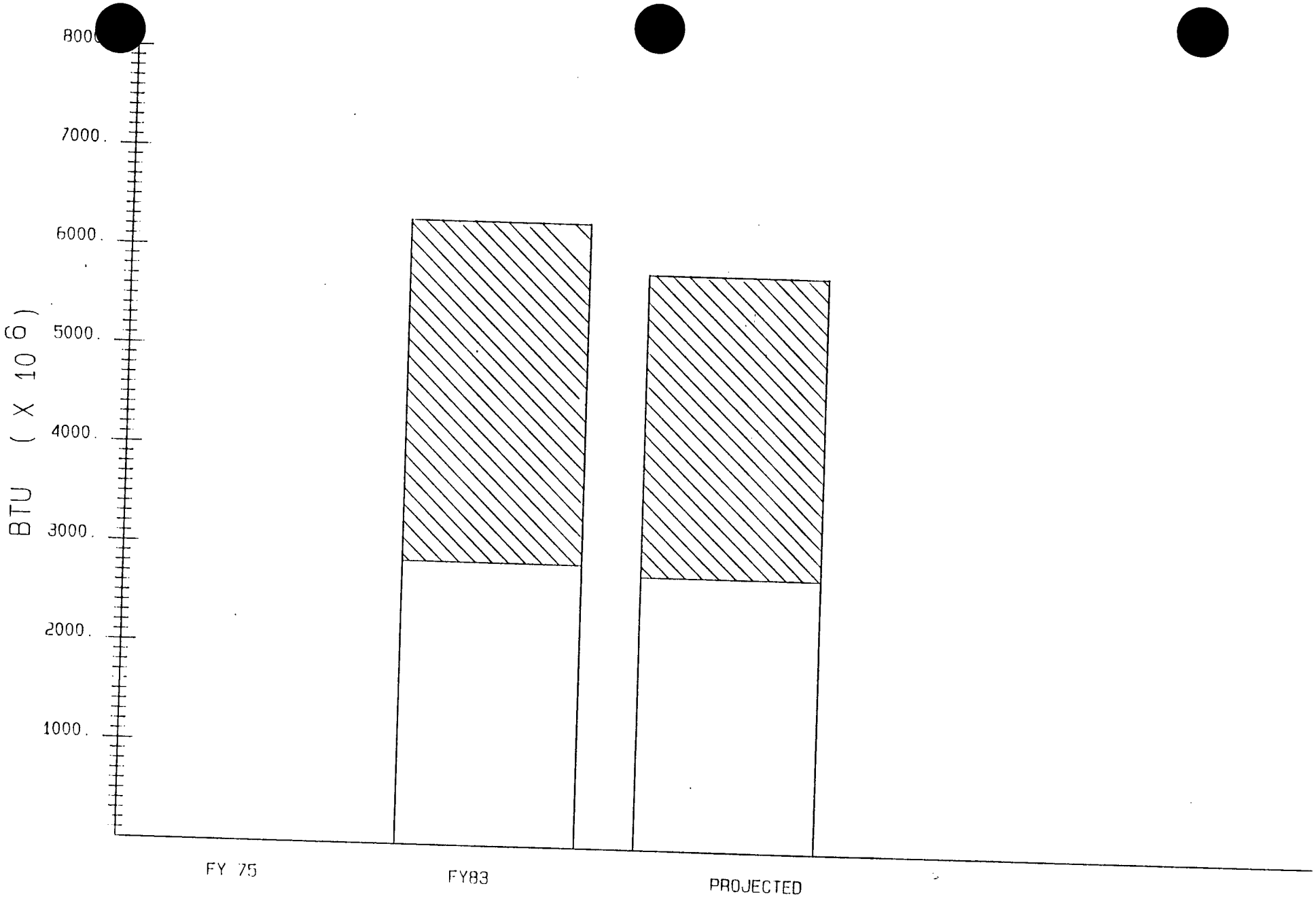
FIGURE 5.18,



THOMAS JEFFERSON VILLAGE GY-241 TOTAL ENERGY CONSUMPTION,

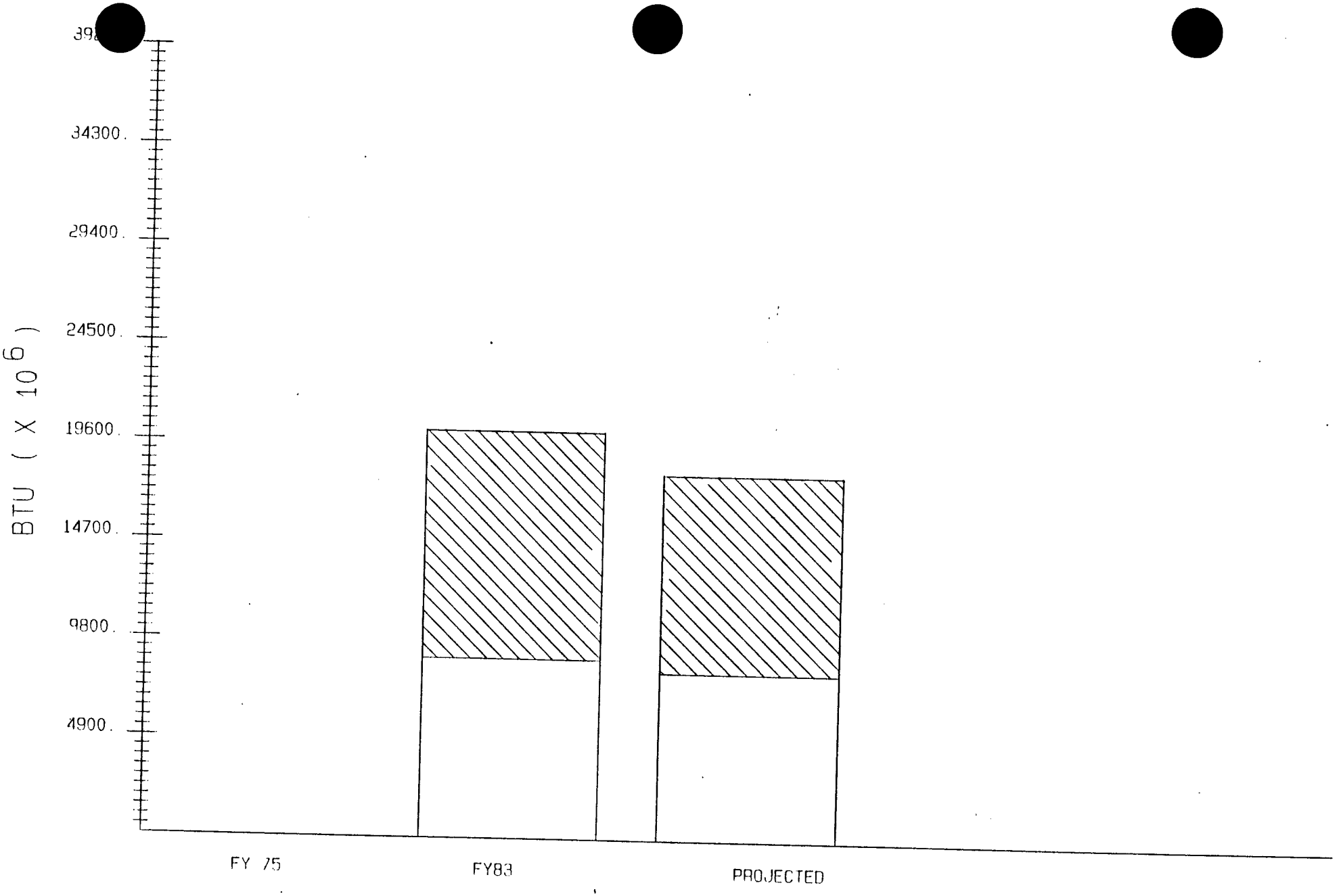
Refer to Legend for Energy Type and BTU Equivalency

FIGURE 5.19,



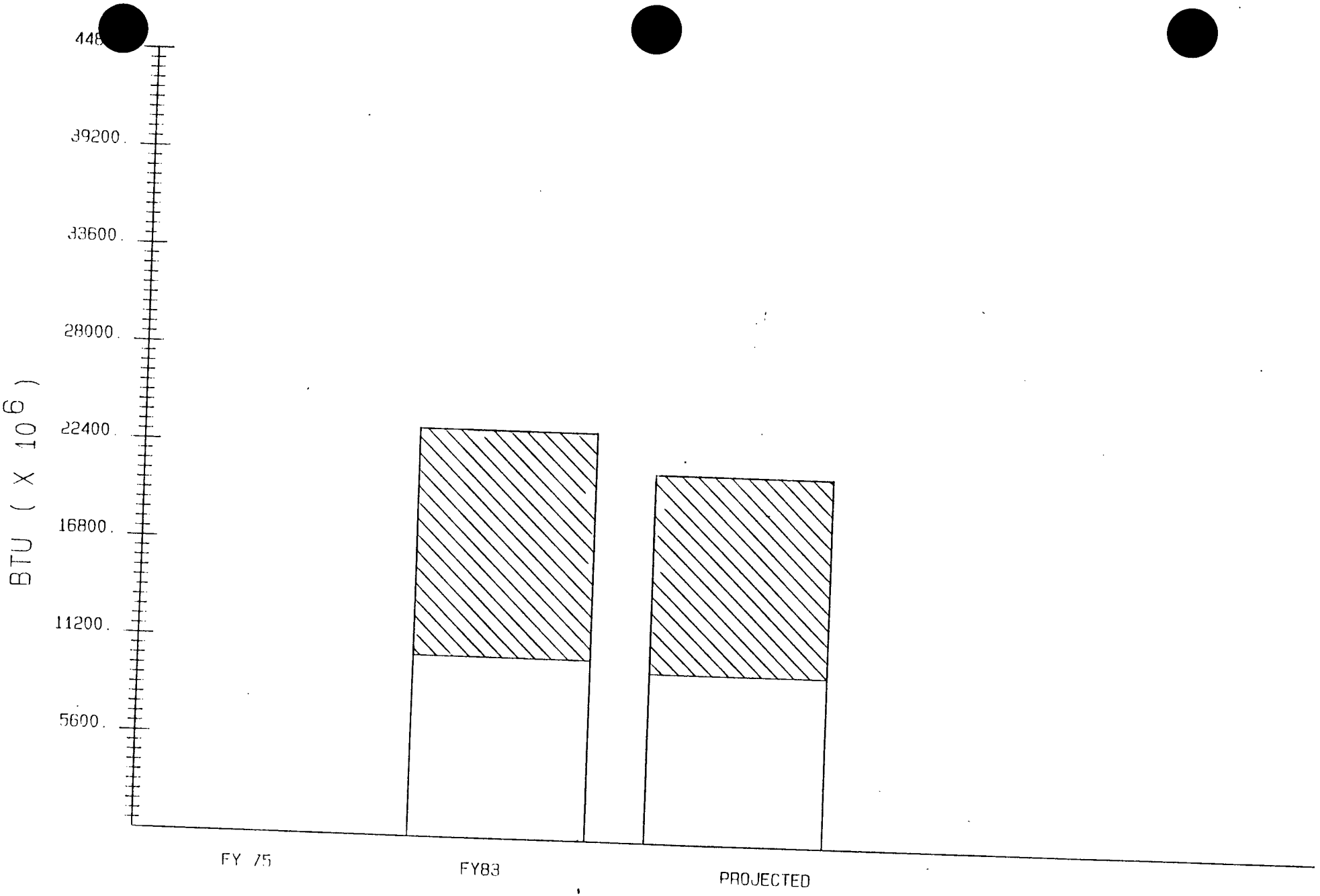
HAIDE LABOR SERVICE CAMP GY-390 TOTAL ENERGY CONSUMPTION,
FIGURE 5.21,

Refer to Legend for Energy Type and BTU Equivalency



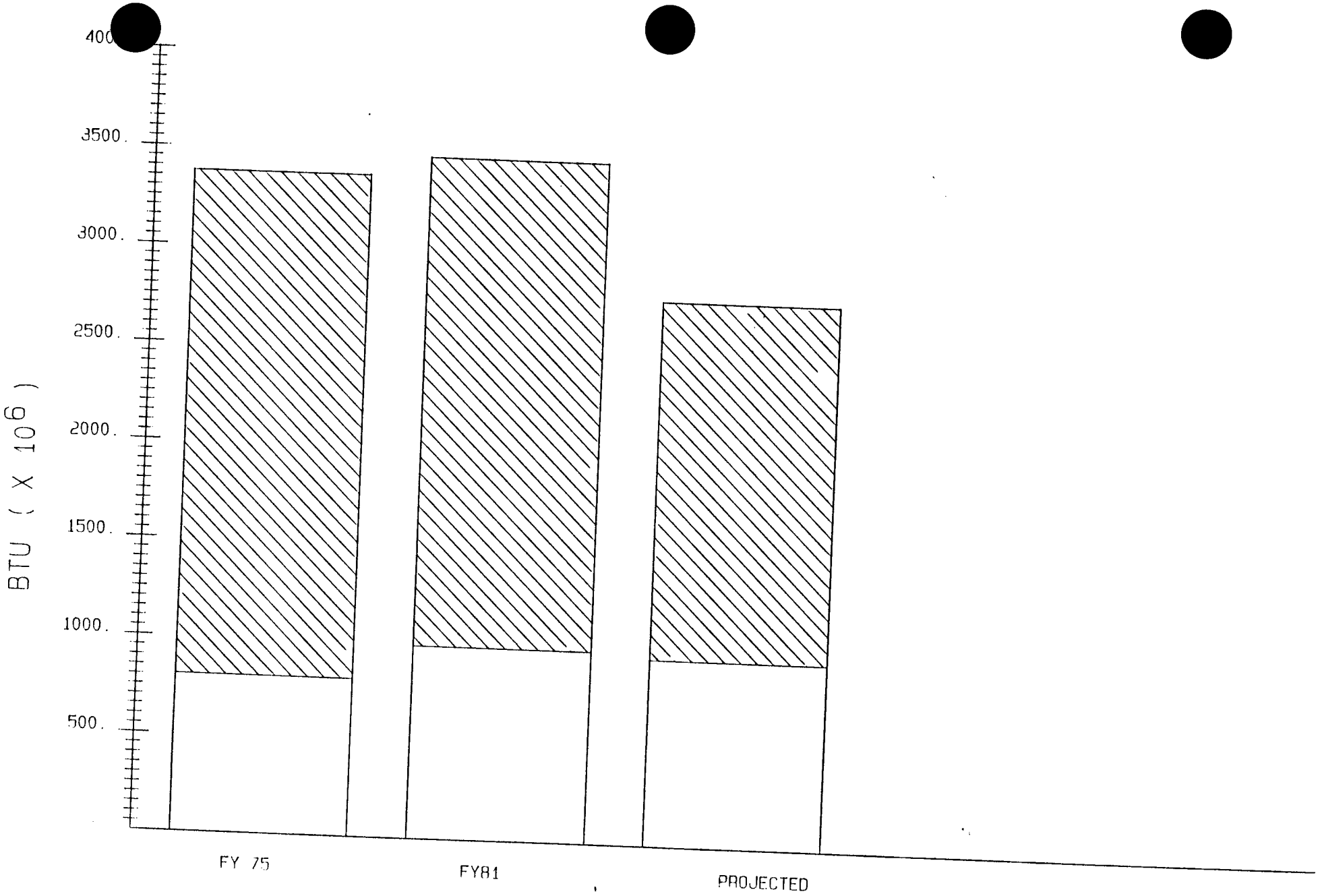
SCHOENBORN MISSLE STATION GY-434 TOTAL ENERGY CONSUMPTION,

Refer to Legend for Energy Type and BTU Equivalency FIGURE 5.22,



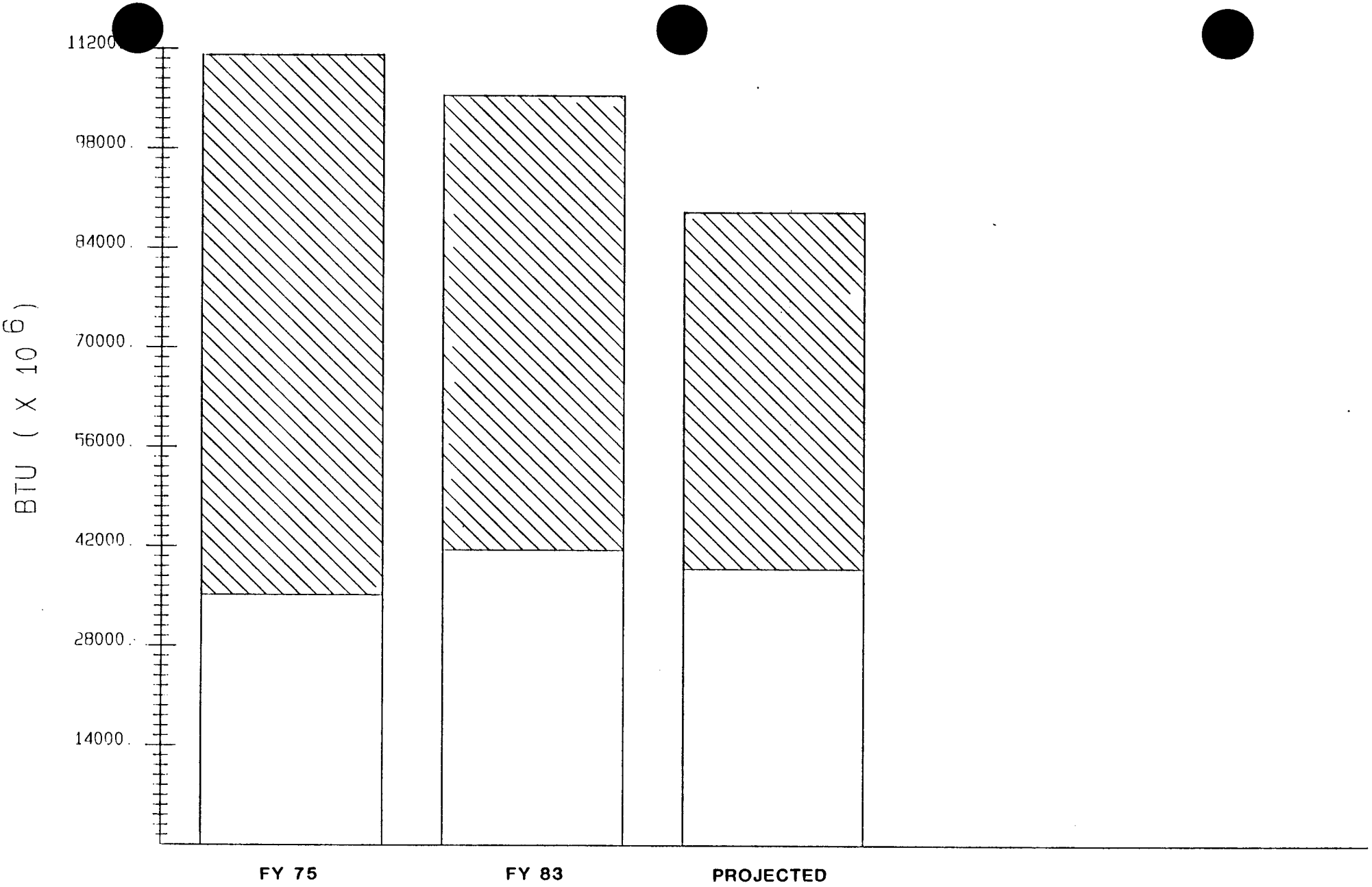
QUIRNHEIM MISSLE STATION GY-435 TOTAL ENERGY CONSUMPTION,
FIGURE 5.23,

Refer to Legend for Energy Type and BTU Equivalency



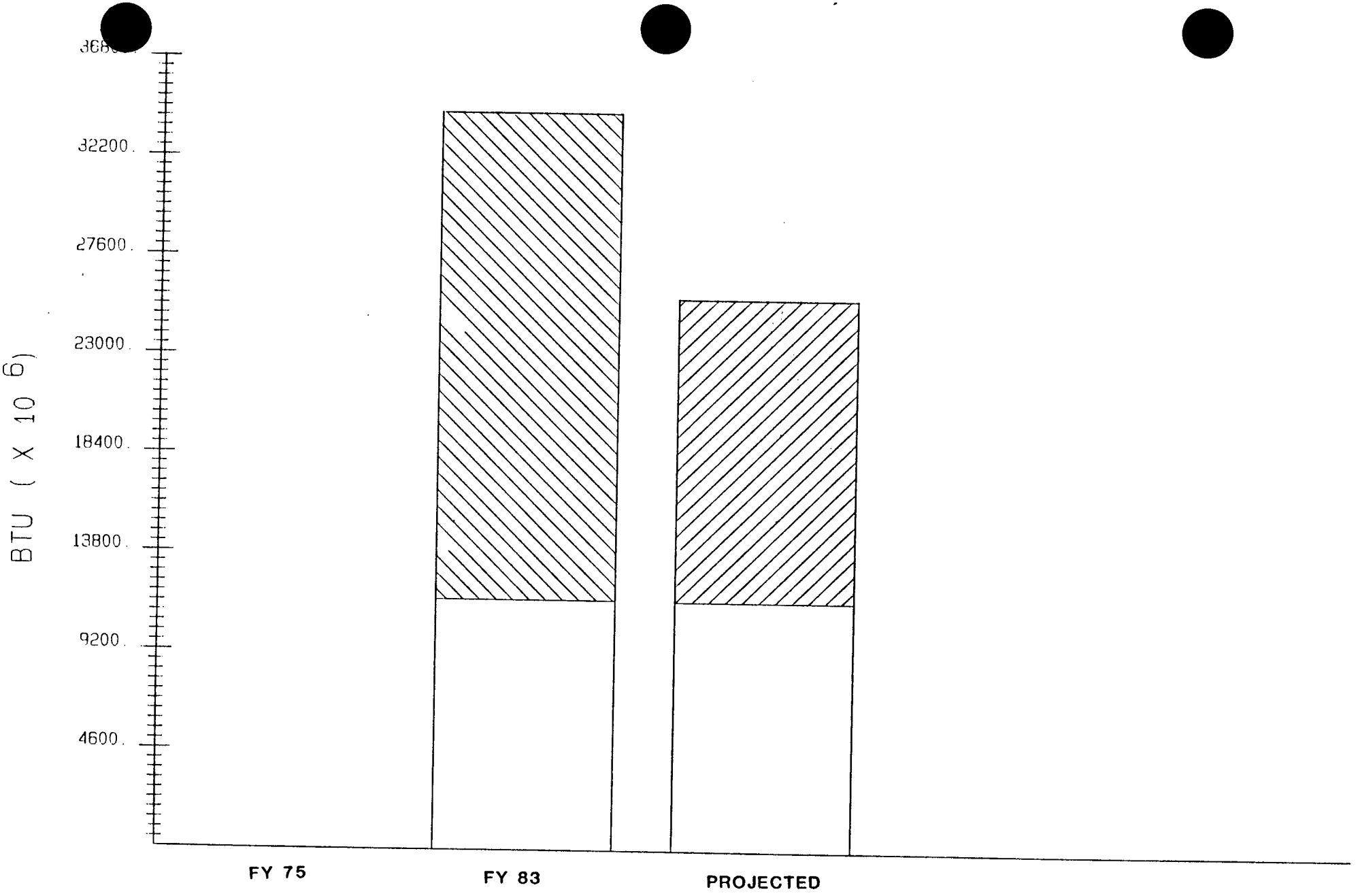
WORMS R&U AREA GY-512 TOTAL ENERGY CONSUMPTION,
FIGURE 5.24,

Refer to Legend for Energy Type and BTU Equivalency



TAUKKUNEN BARRACKS GY-606 TOTAL ENERGY CONSUMPTION,
FIGURE 5.25,

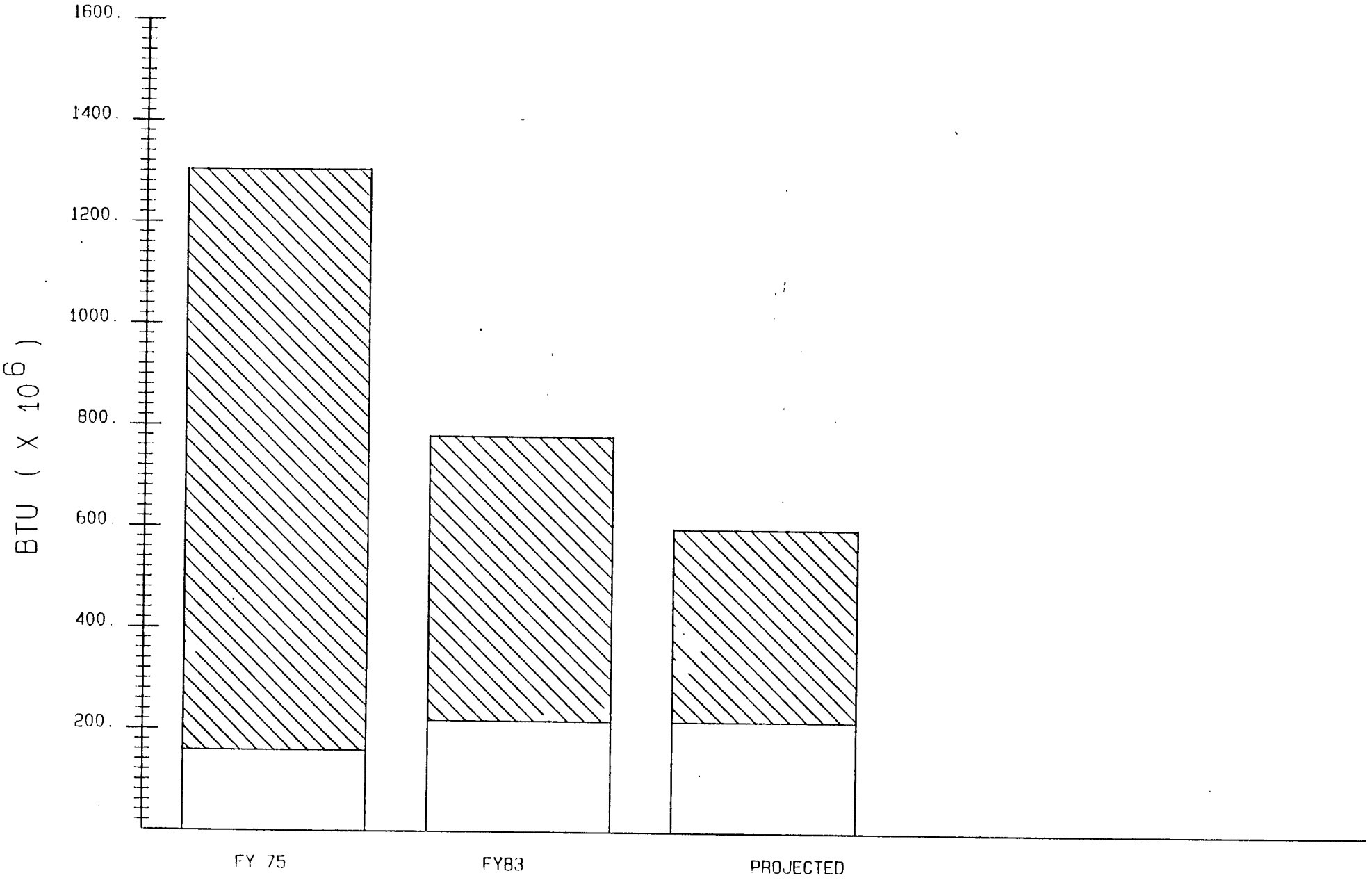
Refer to Legend for Energy Type and BTU Equivalency



WEIERHOF FAMILY HOUSING GY-692 TOTAL ENERGY CONSUMPTION,

Refer to Legend for Energy Type and BTU Equivalency

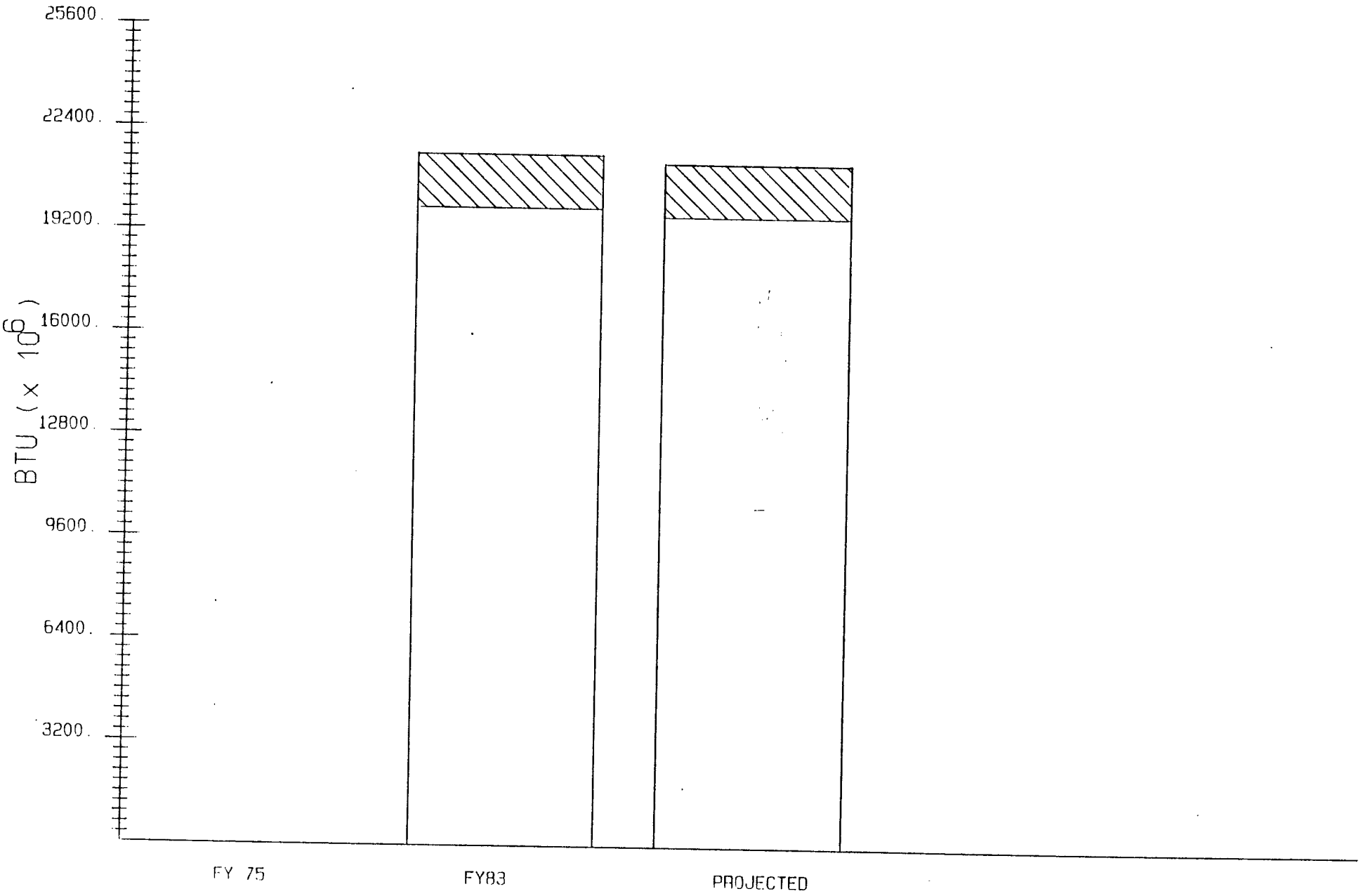
FIGURE 5.26,



WORMS QM AREA GY-775 TOTAL ENERGY CONSUMPTION,

FIGURE 5.27.

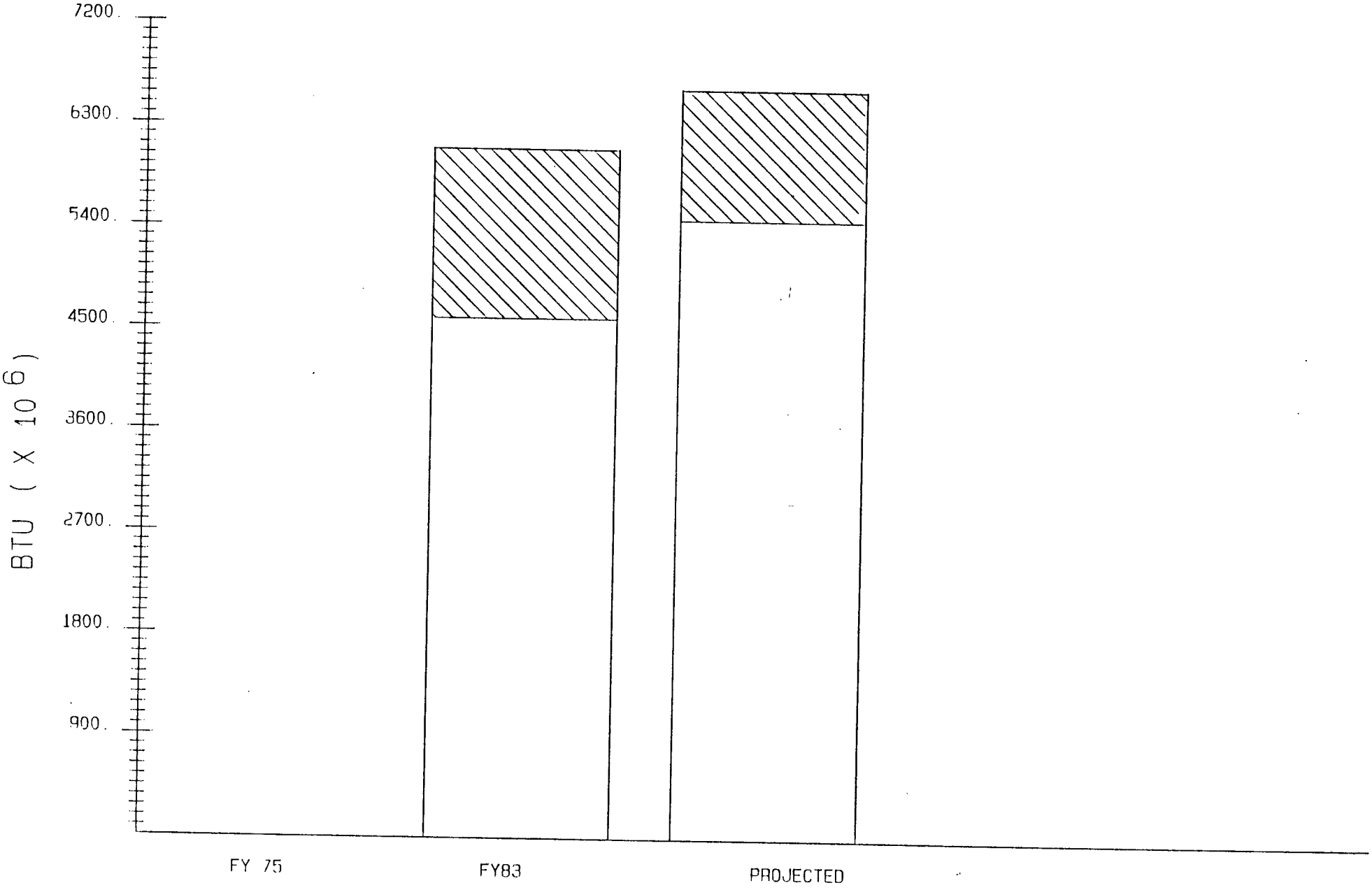
Refer to Legend for Energy Type and BTU Equivalency



DANNENFELS COMMUNICATIONS STATION GY-885 TOTAL ENERGY CONSUMPTION,

Refer to Legend for Energy Type and BTU Equivalency

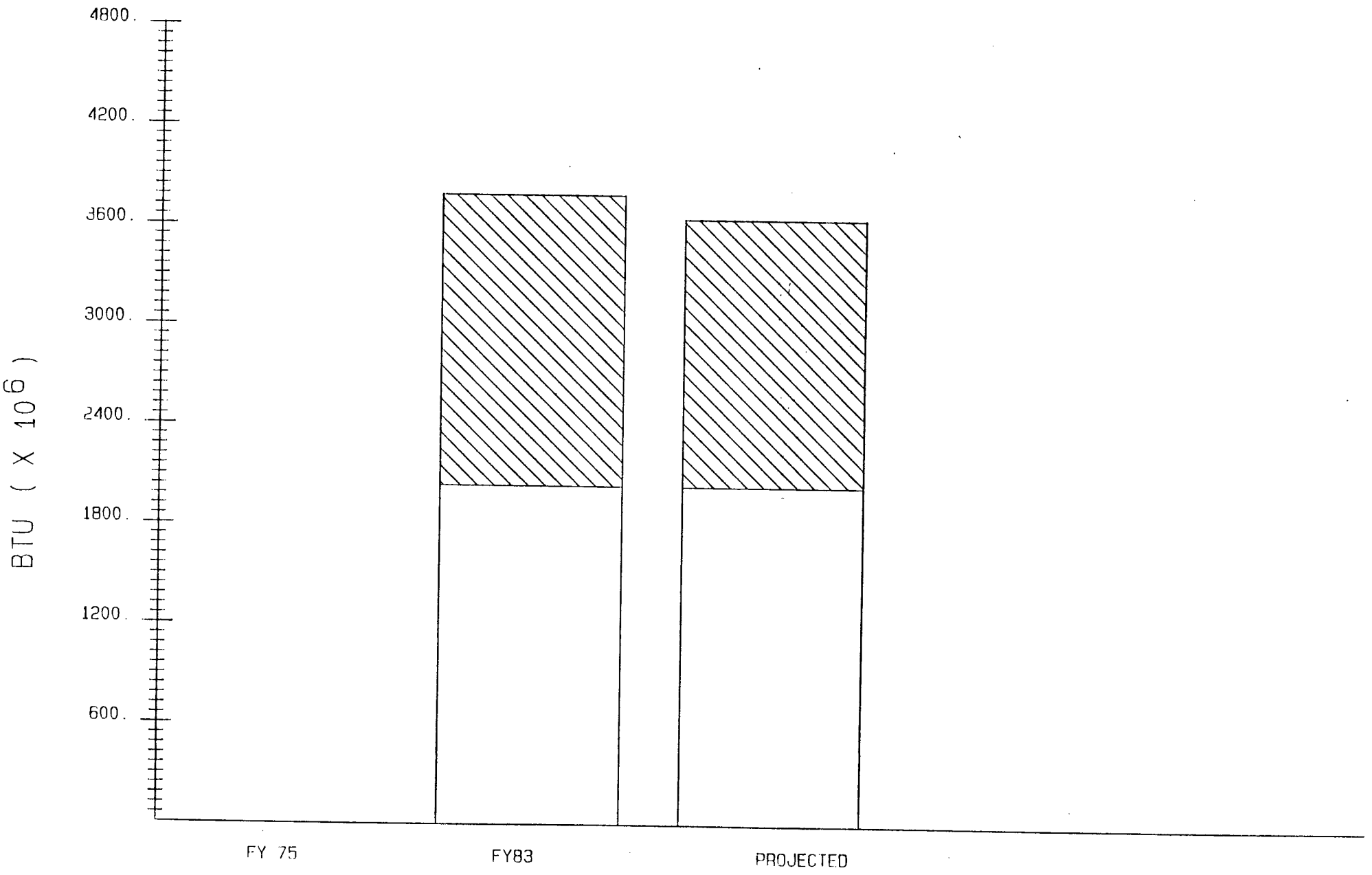
FIGURE 5.28,



HARDENBURG COMMUNICATIONS STATION GY-887 TOTAL ENERGY CONSUMPTION,

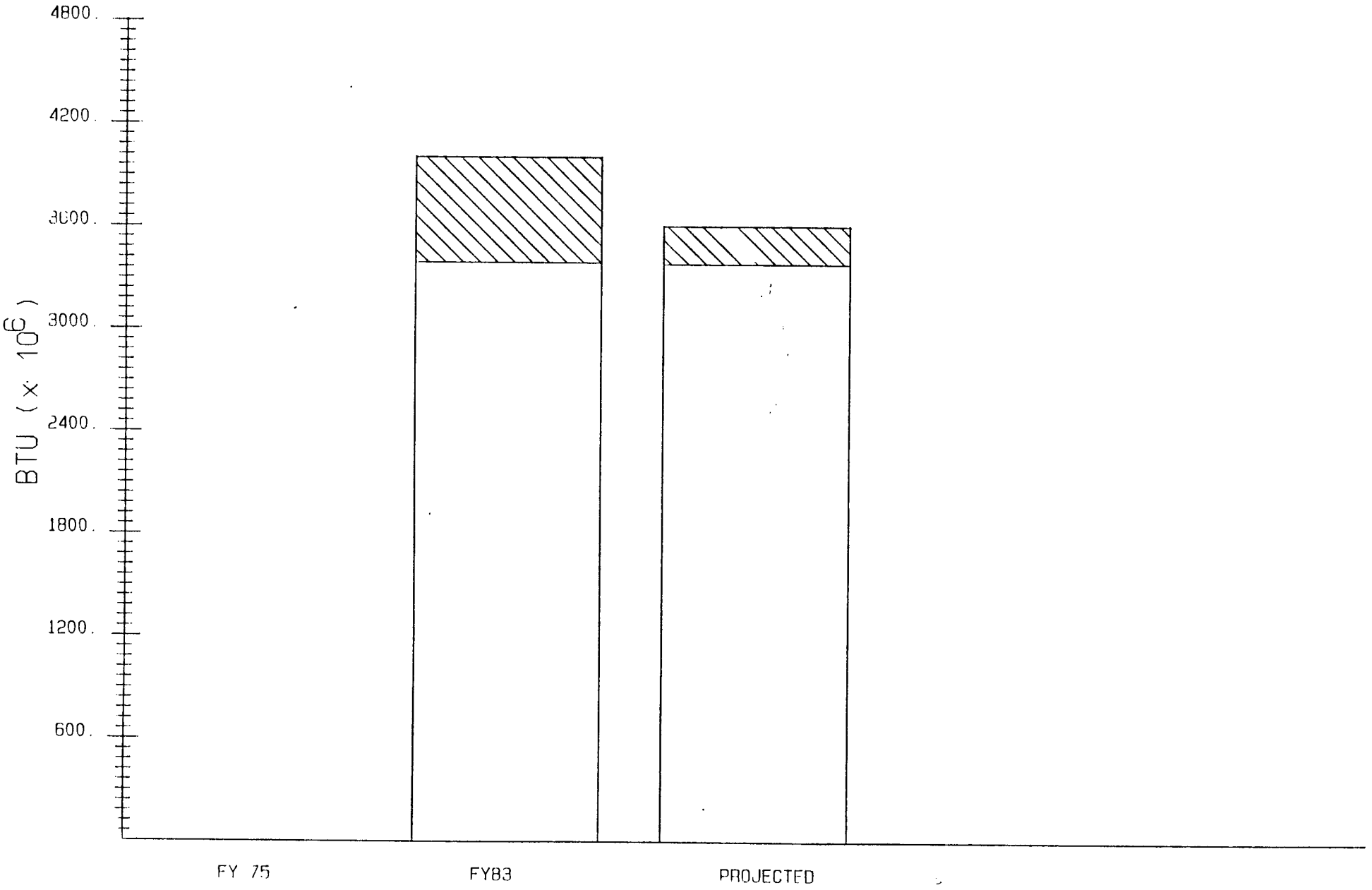
Refer to Legend for Energy Type and BTU Equivalency

FIGURE 5.29,



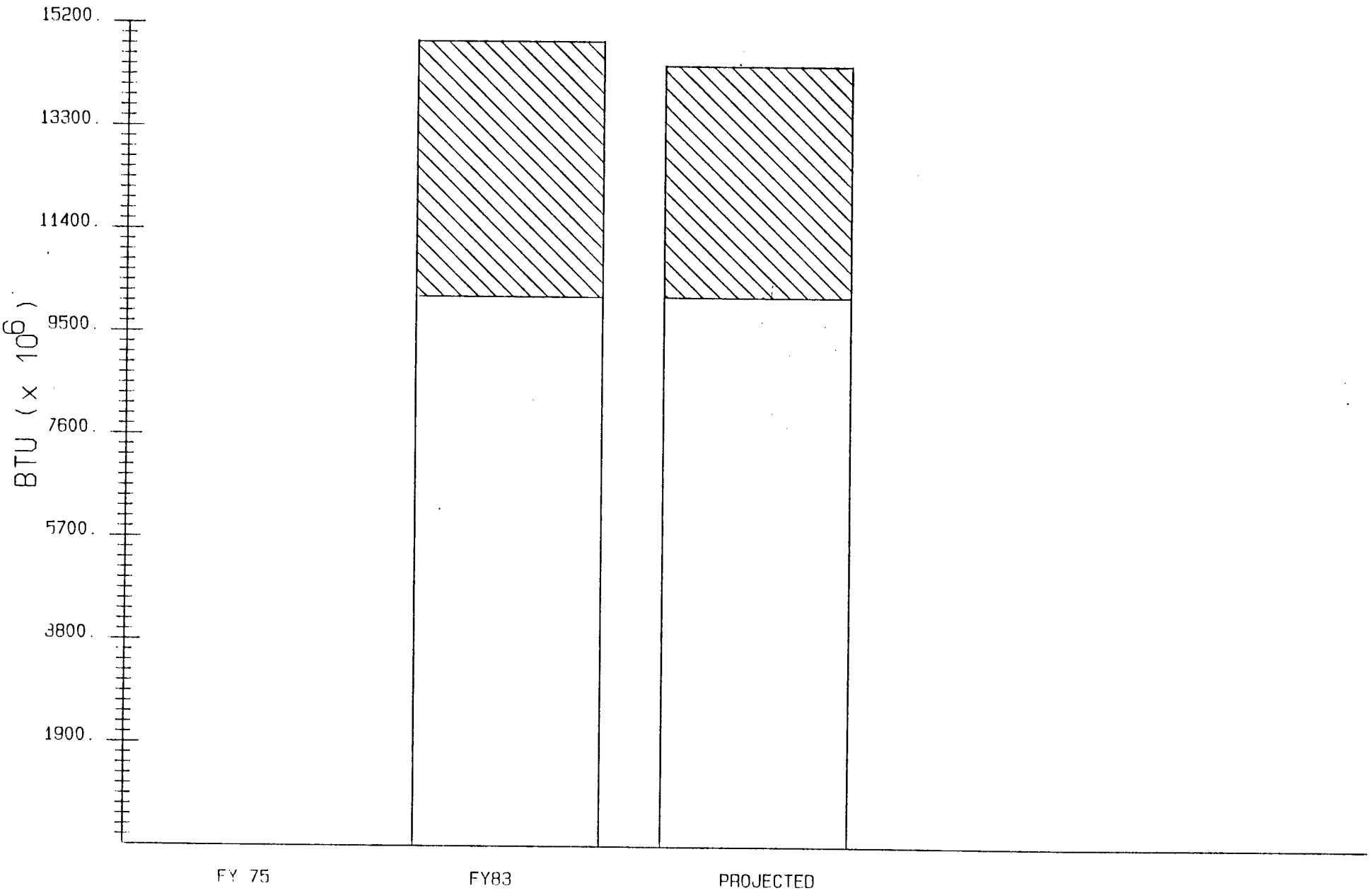
LOHNSFELD COMMUNICATIONS STATION GY-889 TOTAL ENERGY CONSUMPTION, FIGURE 5.30,

Refer to Legend for Energy Type and BTU Equivalency



AUSTIN RADIO RELAY STATION GY-A01 TOTAL ENERGY CONSUMPTION,
FIGURE 5.31,

Refer to Legend for Energy Type and BTU Equivalency



GRUENSTADT COMMUNICATIONS STATION GY-A27 TOTAL ENERGY CONSUMPTION, FIGURE 5.32.

Refer to Legend for Energy Type and BTU Equivalency

TABLE 5.33
TOTAL ENERGY CONSUMPTION (MBTU/YR)
PERCENT CHANGE

INSTALLATION	FY 75	FY 85	PROJECTED	75-83	83-PROJ	75-PROJ
GY 035	-	55,461	48,609	-	-12.35	-
GY 144	7,505	12,176	11,094	62.24	-8.89	47.82
GY 241	127,933	113,697	88,969	-11.13	-21.75	-30.46
GY 256	-	265,783	226,620	-	-14.73	-
GY 390	-	6,299	5,806	-	-7.83	-
GY 434	-	20,219	18,162	-	-10.17	-
GY 435	-	23,440	21,168	-	-9.69	-
GY 512	3,375	3,475	2,781	2.96	-19.97	-17.60
GY 606	111,510	105,794	89,422	-5.13	-15.48	-19.81
GY 692	0	34,352	26,472	-	-22.94	-

TABLE 5.33

TOTAL ENERGY CONSUMPTION (MBTU/YR)

PERCENT CHANGE

INSTALLATION	FY 75	FY 85	PROJECTED	75-83	83-PROJ	75-PROJ
GY 775	1,304	780	599	-40.18	-23.21	-54.06
GY 885	-	21,584	21,338	-	-1.14	-
GY 887	-	6,089	5,727	-	-5.94	-
GY 889	-	3,781	3,641	-	-3.70	-
GY A01	-	4,003	3,602	-	-10.02	-
GY A27	-	14,864	14,424	-	-2.96	-
TOTAL	-	691,797	588,434	-	-14.94	-

TABLE 5.34

ECIP PROJECT RANKING
BY SAVINGS/INVESTMENT RATIO

PROJECT	SIR
Boiler Consolidation - 9 Buildings @ GY 692	2.822
Roof Insulation - 28 Buildings, 5 Installations	2.748
Boiler Consolidation - 25 Buildings @ GY 241	2.463
Roof Insulation - 29 Buildings, 6 Installations	2.375
EMCS @ GY 256	2.221
Building Insulation - 4 Building @ GY 692	2.195
Wall Insulation - 16 Building, 8 Installations	1.462
Building Insulation - 3 Buildings @ GY 241	1.377